Vol. 25 JANUARY, 1905 No. 149

THE FOUNDRY

PUBLISHED MONTHLY BY
THE PENTON PUBLISHING CO.
CLEVELAND, OHIO.

WE ARE

HEADQUARTERS

FOR

Foundry Facings **Foundry Supplies**

Foundry Equipments

When we say *Headquarters*, we want to convince you of this, for we carry in stock, ready for immediate and prompt delivery,

"EVERYTHING YOU NEED IN YOUR FOUNDRY"

Have you ever visited any of our three large warehouses, one at Cincinnati, at Chicago, or at Pittsburg? Have you ever seen the most perfect system we have adopted to know that our stock is kept up in every detail — nothing lacking, so that we

CAN SHIP ORDERS SAME DAY AS RECEIVED

Send for general catalogue No. 40.
An encyclopedia of Founders' requisites.

The S. Obermayer Co.

Cincinnati, O. **Chicago, Ill.** **Pittsburg, Pa.**

ESTABLISHED 1874

Cable address "Esso" all codes.

The Sign of a good Foundry

There are many such. They are using

Cherry Valley Iron

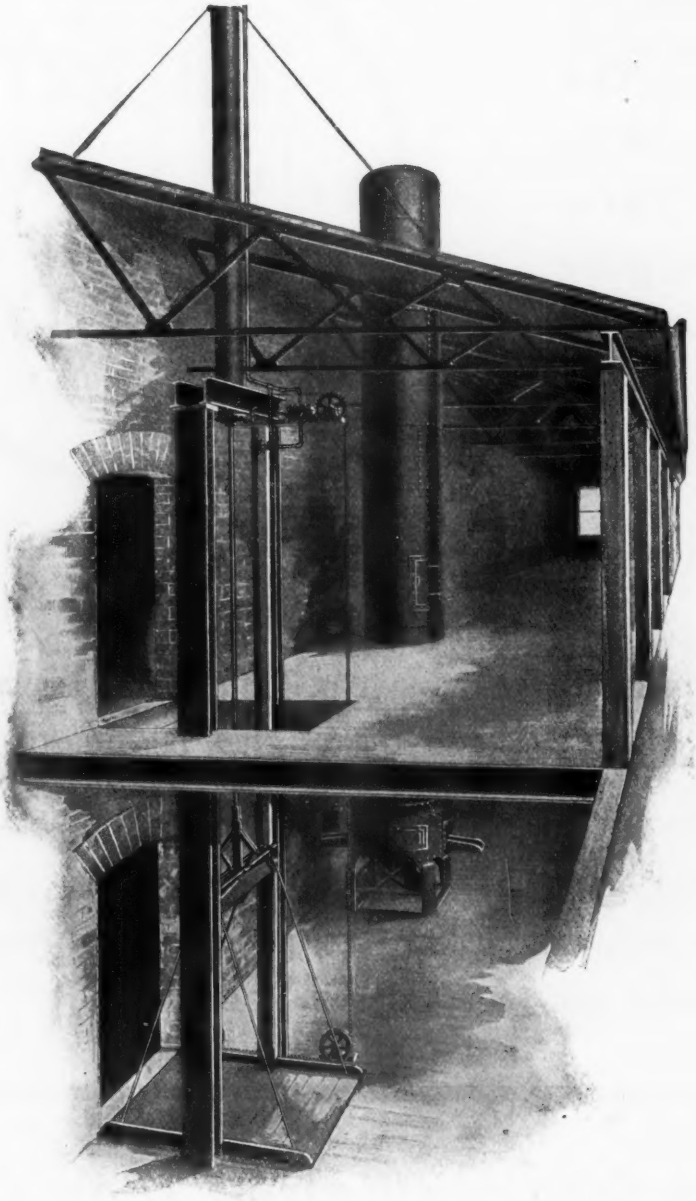
constantly year by year. The reason is plain —the best iron makes the best castings.

If you want soft, strong, true-to-pattern, easy-to-machine castings that will give your foundry a place up in front send your order now for Cherry Valley.

The Cherry Valley Iron Co.

Pittsburg, Pa.

Pneumatic Foundry Elevators



CURTIS & CO. MANUFACTURING CO.

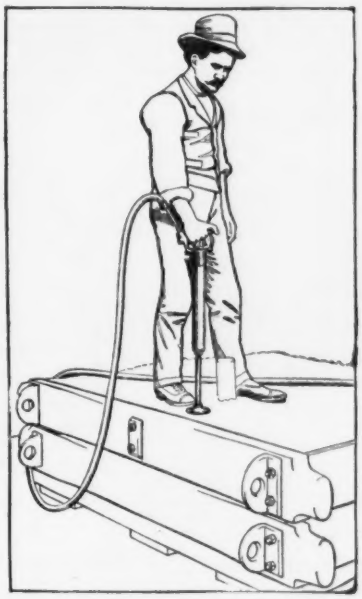
ST. LOUIS, MO.

TOOLS OF QUALITY

KELLER TOOLS

THE KELLER
LABOR SAVERS

FOUNDRY RAMMERS



This cut illustrates our No. 7 Rammer with spade handle.

Equipped with straight handle also—see cut opposite.

Our No. 7 Rammer with straight handle.

We make them in four sizes.

"HAS IT EVER OCCURRED TO YOU"
that your cost of production could be greatly reduced by the use of the KELLER RAMMERS?

Let us tell you all about them in our circular. It's free to you.

PHILADELPHIA PNEUMATIC TOOL CO.
21st and ALLEGHENY AVE. . . . PHILADELPHIA, PA.

BRANCH OFFICES

NEW YORK CHICAGO PITTSBURG SAN FRANCISCO ST. PAUL

FOUNDERS--ATTENTION

The Steele-Harvey

CRUCIBLE MELTING FURNACE

Used in connection with Oil, or Gas and Air.

For melting Copper, Bronze, Aluminum German Silver, Iron and Steel. Special furnaces for Babbitt Metal, Solder, Etc.

Guaranteed lowest cost to manufacture. Less Oil or Gas consumed, LESS WASTE OF METAL. Metal POSITIVELY WILL NOT OXIDIZE.

Capacities from 50 to 900 lbs. per heat.
Prices from $150.00 to $450.00 each.
Freight paid, and installed without additional charge.

Send for Catalogue

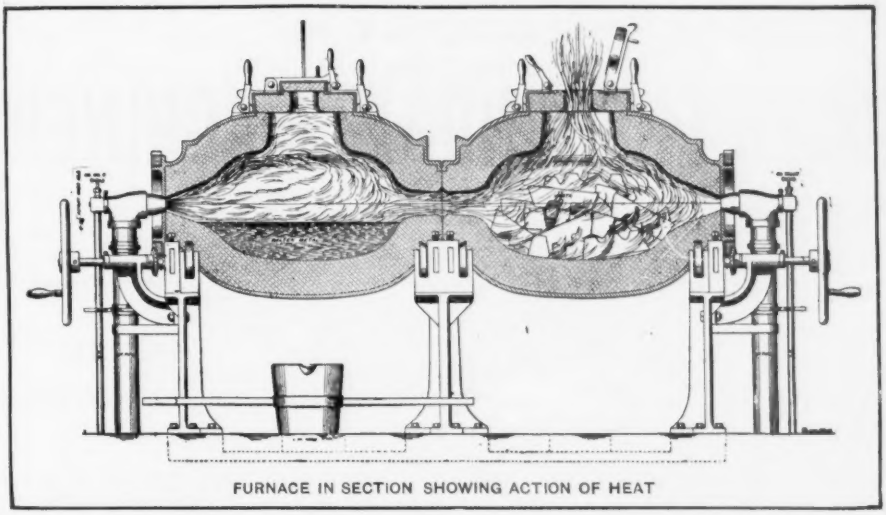
Manufactured by

The Monarch Engineering & Mfg. Co.

BALTIMORE, MD.

Works: Curtis Bay, Md.

"The Furnace That's Always Working"



FURNACE IN SECTION SHOWING ACTION OF HEAT

The Rockwell Rotary Melting Furnace

Entirely dispenses with crucibles. This alone is a great saving. The fuel is oil or gas and the air for combustion is supplied from an ordinary fan. No ashes nor loss of metal in ashes.

A casting equal to more than twice the rated capacity of one chamber may be made. Very convenient sometimes.

Will melt two kinds of metal at the same time. For instance, a charge of copper may be melted in one chamber and a charge of any other metal in the other and both be poured at the same time.

The linings are very simple and inexpensive. There is no cutting or fitting and no skilled labor necessary to reline. The lining material is rammed in in bulk, like sand in a mold. It is then burned solid in the furnace, becoming very hard and refractory.

Made in four standard sizes ranging in capacity from 350 to 3,000 pounds each chamber.
Catalogue on request.

ROCKWELL ENGINEERING COMPANY
26 CORTLANDT STREET
NEW YORK

William Sellers & Co. Incorp.

PHILADELPHIA, PA.

MODERN FOUNDRY MACHINERY

SAND MIXER

Not an Experiment

PRACTICAL
ECONOMICAL
EXPEDITIOUS

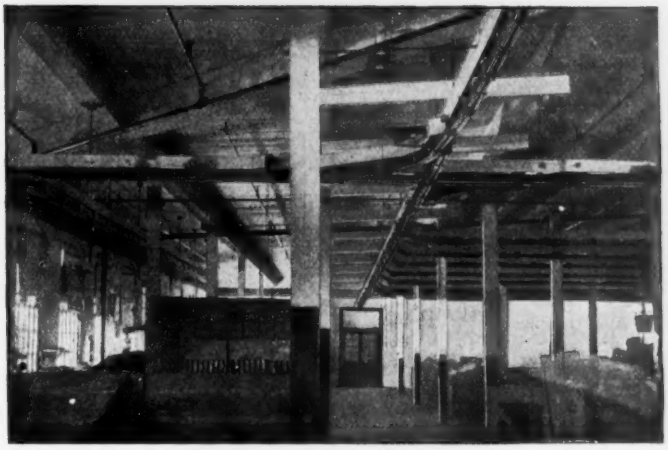
NOTE. — In order to clearly explain the **Modus Operandi** of this scientific and practical method of **mixing Molding Sand, Facing Sand** and **Core Sand,** we have issued a small pamphlet which will be sent on application.

TRAVELING CRANES FOR FOUNDRY USE.

Correspondence is Solicited.

Just What Your Foundry Has Needed For Years

Coburn Trolley Tracks



ROLL YOUR STUFF ALONG

Coal to the boilers — Iron to the cupola — Flasks and sand to the molders. All foundry material anywhere quickly with little cost and clear gangways.

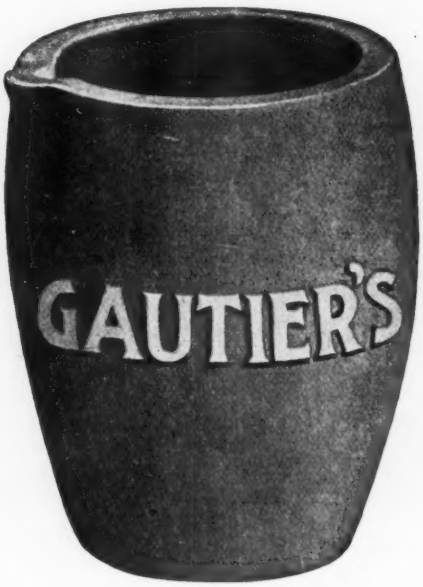
The Money-Saving Way

Send for No. 20 Catalogue

The Coburn Trolley Track Mfg. Co.

Holyoke, Mass., U. S. A.

A Dependable Crucible for all Metals



The Standard
of crucible excellence
and uniformity, for half a century

J. H. Gautier & Co.

JERSEY CITY, N. J.

This trade mark stands for the acme of crucible uniformity.

There's no guess work in the manufacture of a Taylor Crucible. Only the highest grades of material are used, and working strictly by our chemical analysis, we give a uniformity in the quality the year round, that is not approached.

A trial will convince you.

Robert J. Taylor, Incorporated

1900 to 1916 Callowhill Street

PHILADELPHIA, PA.

THE MERIT OF QUALITY

A Foreign Ministry, in considering the solicitation of a contractor for an extension of three years on his contract for supplying the Royal Mint with Dixon's Plumbago Crucibles, decided to make the extension for two reasons:

First, for the convenience of the Administration.

Second, because, during the two and a half years the contract had been running, the high quality of Dixon's Crucibles had made it unnecessary to use more than one-tenth of the number of crucibles that the contractor had been given to understand would be required.

The quality of Dixon's Plumbago Crucibles is the element which makes them distinct from any other plumbago crucible. It is this quality which has made them the standard for seventy-seven years.

The value and worth of the Dixon Crucible is known and acknowledged throughout the entire world.

JOSEPH DIXON CRUCIBLE CO.

JERSEY CITY, N.J., U.S.A.

For Crucible Quality—DIXON'S

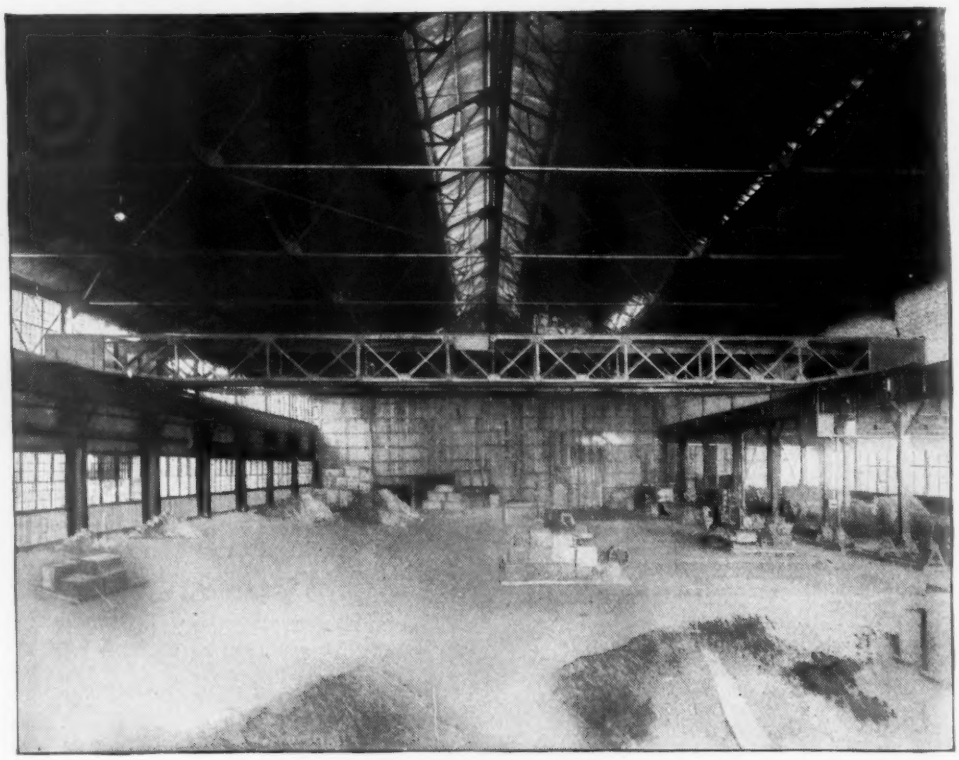
McCULLOUGH-DALZELL
No.
00 TO 300
CRUCIBLE CO
PITTSBURG PA.

¶ Your workmen's safety is closely bound with your economical interest. Poor crucibles are dangerous and wasteful. Life and profits are safe with the McCullough-Dalzell makes.

Send for Booklet

McCullough - Dalzell
Crucible Co.

Pittsburgh
Pa.



Three-motor Electric Traveler, 10-tons capacity, 98-ft. span. Furnished McCormick Division, International Harvester Co., Chicago.

ELECTRIC TRAVELERS

CRANES OF ALL KINDS

ALL TYPES

ENGINEERS, DESIGNERS AND MANUFACTURERS

COMPLETE EQUIPMENT FOR

GRAY IRON, CAR WHEEL AND PIPE FOUNDRIES

MALLEABLE AND STEEL CASTING PLANTS

1300 IN USE

Catalog "F" on request

See our Operating Exhibit at Model Foundry, World's Fair

WHITING FOUNDRY EQUIPMENT CO.

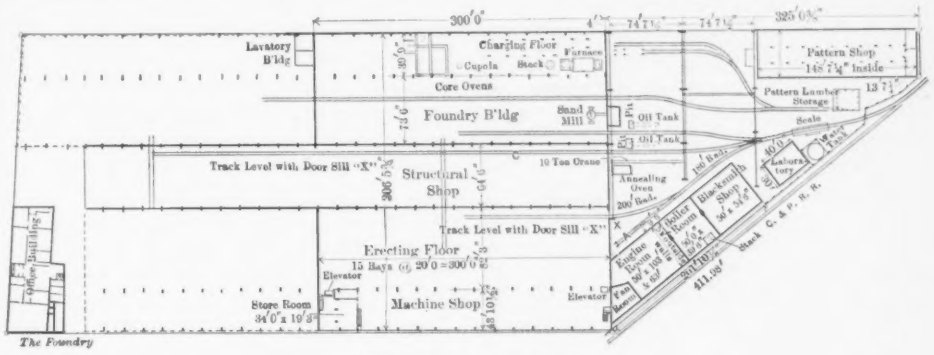
GENERAL OFFICE AND WORKS: HARVEY, ILL., U. S. A. (CHICAGO SUBURB)

THE FOUNDRY

Vol. 25, No. 5. *CLEVELAND, OHIO, JANUARY, 1905.* *Whole No. 149*

Steel Foundry of the Wellman-Seaver-Morgan Engineering Company, Cleveland, O.

It is an old statement that the proof of the pudding is in the eating. It is evident that the Wellman-Seaver-Morgan Co. believe that their own devices are the best and are capable of producing work cheaply, for they have installed one of their own plants for producing the steel castings necessary for their work and also for commercial work. The equipment is modern in every respect and is doing very effective work. As will be noted from the ground plan, the steel foundry is a building 300 ft. by 113 ft. The storage yard is arranged at one end of the steel foundry between it and the pattern shop, and the cleaning department occupies one end of the long shop adjoining the foundry, the other end being occupied by the structural shop.



GENERAL PLAN OF WORKS

Melting Equipment.

The melting equipment consists of one 20-ton open hearth Wellman rolling furnace, from which they obtain from three to four heats per day. The furnace is ordinarily fired with natural gas, but when, due to breaks in the gas mains or from any other cause, the supply of gas fails, they use oil from storage tanks kept under ground. Special circulating pumps are arranged for handling the oil and it can be substituted for the gas in a very few minutes, so that the failure of the gas supply would not interfere with the heat in the least.

For use in connection with the re-carbonizing process, when they desire to follow it, they have a cupola of 30 inches inside diameter, which is used for melting the spiegeleisen. Ordinarily, however, they are able to make their steel of the desired composition without resorting to re-carbonizing. In a steel foundry it is very necessary to have a thoroughly reliable furnace and one that can run continuously without breakdowns or the necessity of stopping for repairs. The furnace now in use has been in continuous operation from February, 1904, to date and they inform us that it could be run for several months longer, though they will probably repair it, as is their custom, the first of the year.

The furnace is charged with the Wellman charging machine, and by keeping an accurate set of cost accounts they have proven conclusively that a great saving can be made by the use of this machine, even with a single furnace, both on account of reduction of the number of men necessary about the furnace, and also on account of the fact that the work can be done much more expeditiously and in less space. The charging boxes are filled at various places, and in fact, any scrap pro-

GENERAL VIEW OF FOUNDRY.

duced about the works is loaded into the charging boxes at the place where it is produced. These boxes are loaded onto trucks by means of the traveling cranes, the trucks taken to the foundry yard by an electric locomotive and switched around to the elevating mechanism for carrying them to the charging platform. The pig iron scrap, limestone, and other materials for making up the charge which are stored in the yard, are all stored under two yard traveling cranes so located that they can handle the boxes from the supply bins or cars to the hoist, leading to the charging floor. This reduces handling to a minimum.

The charging machine is also so arranged that it can remove the furnace doors, and when the arch above one of the furnace doors needs repairing, it can be replaced without stopping the heat by the use of the Johnson patent arch plate made by this company and shown in one of the accompanying illustrations. This arch plate is picked up by the charging machine and placed in the door opening in place of the door which has just been removed. The lower part of the plate serves as a stop or shield, and protects the workmen from the heat of the furnace. The old arch is then torn away and a new one built on top of the arch plate, using the upper surface of the latter as a form. When the arch is complete, the charging machine removes the arch plate and replaces the door. This operation is carried on while the charge of steel is being melted down and does not interfere with the work in any way.

Molding Equipment.

A large proportion of the molding, including all the heavier work, is done on the

1. CORE DEPARTMENT. 2. GENERAL VIEW OF MELTING EQUIPMENT.

CASTING FINISHING ROOM.

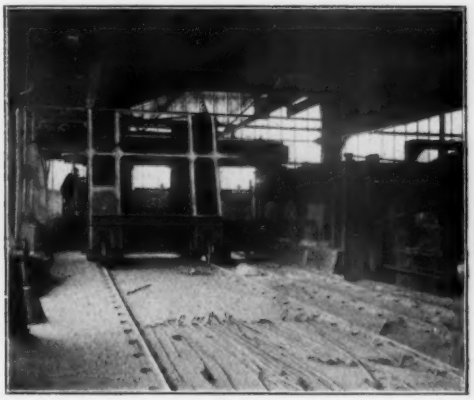
foundry floor. There is a pit about the middle of the foundry for use in connection with the pouring of long or large work. All of the flasks for regular or standard work are made from steel castings and are very carefully fitted up. For handling the special or standard lines of manufacture, including all castings for which they get orders for a considerable number, they have arranged molding machines of their own make. These are mostly the plain stripping plate type. In connection with the larger ones they use pneumatic rammers, and the rammers are supported from light jib cranes, so that the rammer always hangs in a vertical position whether in use or not. This greatly prolongs the life of the rammer and aids in keeping it in repair.

WELLMAN TILTING FURNACE.

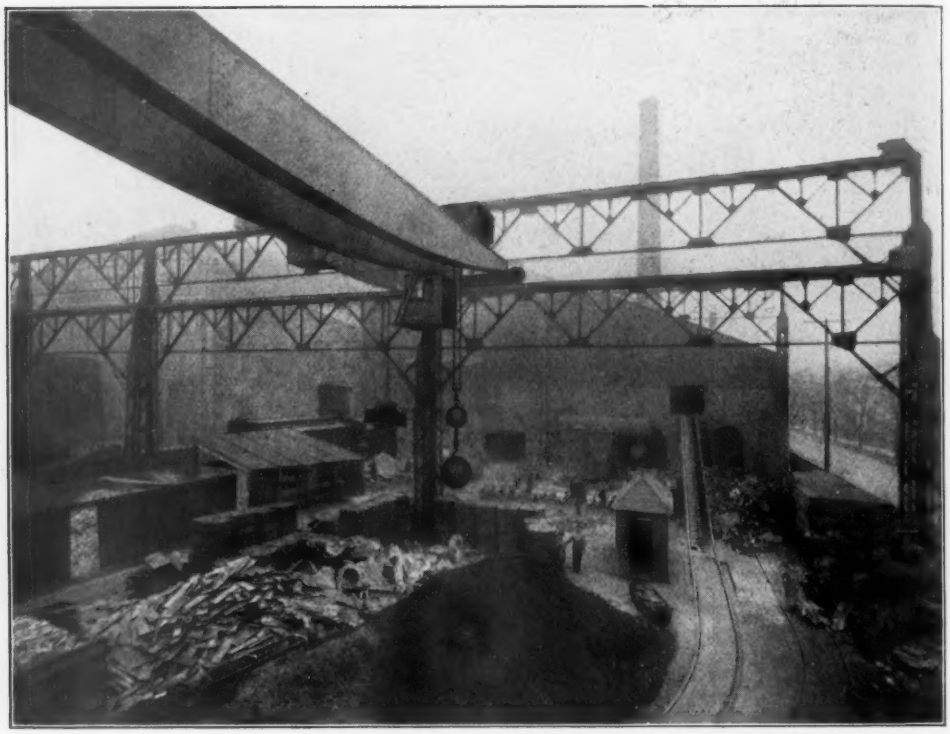
The core department is equipped with three ovens, two 16 feet wide, 10 feet high and 30 feet deep, and one 8 feet wide, 9 feet high and 12 feet deep. The core department in a steel foundry is a very important part of the works, on account of the fact that the cores for steel castings have to be carefully made to prevent the metal from burning or cutting into them.

Handling Equipment.

In the main bay of the foundry there are three traveling cranes. Two of 10-ton capacity and one 30-ton crane, with a 5-ton auxiliary hoist. There are also four 2-ton electrically



WELLMAN CHARGING MACHINE.



FOUNDRY YARD.

operated jib cranes, three of which are located over the smaller molding machines and one over a portion of the cleaning floor. A 5-ton electrically operated traveling crane passes over the core department which is located in the bay on the east side of the foundry and north of the charging floor. In the cleaning department there is a 10-ton traveling crane of 60 ft. span, and 240 ft. runway over the cleaning floor. In the yards there are two 10-ton traveling cranes, the one nearest the foundry having a span of 70 ft. and runway of 160 ft. and a lift of 35 ft. under the hook. This crane is provided with two drums, to facilitate the opening and closing of clam shell grab buckets which are used in handling the molding sand. The other yard crane has a span of 70 ft. and runway 160 ft. long and a lift of 25 ft. under the hook. This crane also commands the platform of the pattern storage so that it can

ANNEALING OVEN.

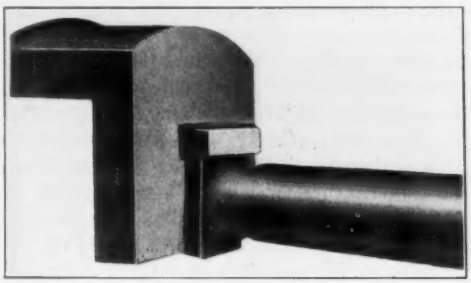
LARGE MOLDING MACHINE FLOOR.

deliver patterns from the pattern storage on to trucks for transportation to the foundry.

In addition to the traveling cranes, provision is made for the standard gauge railway cars to be brought into either the steel foundry or the cleaning department and for the industrial railway to pass through each of these departments. The industrial railway cars are operated by an electric locomotive.

Preparation of Sand.

The greater part of the molding sand used is of one kind and this is stored in a bin holding 150 tons and located outside of one end of the foundry and over the superintendent's office. Sand is received in cars on the railroad, is unloaded from the cars by means of a clam



JOHNSON PATENT ARCH PLATE.

shell grab bucket operated by the traveling crane. This grab bucket deposits the sand in the bins already referred to. The sand passes from the bins by gravity through a chute to the grinding pan used in mixing and preparing the sand. The other ingredients used, such as clay, other brands of sand, materials for binding, etc., are kept in bins and barrels near the grinding and mixing pan. After the sand is mixed it is taken to the core department or the parts of the floor where it is to be used.

Cleaning Department.

Some of the smaller castings are cleaned in a tumbling barrel located back of the cupola. The larger castings are cleaned on the floor by hand with the aid of pneumatic tools.

For removing gates and risers they have a number of machines of different types, including circular sawing machines equipped with vertical or horizontal saws, a slotting machine and a shaper. For finishing surfaces, grinding off fins, etc., they have an equipment of swinging grinders, together with an equipment of pneumatic chipping appliances. The cleaning department is located at one side of the foundry proper in a building 60 ft. wide, this department occupying 240 ft. of the building, the balance being occupied by the structural shop.

As already stated, both the industrial and standard gauge railroad tracks run through this building so that castings can be loaded on to cars on either system.

At one end of the casting finishing room outside of the building is located an annealing oven 20 ft. long by 10 ft. wide. This oven is equipped with two cars, each 10 ft. by 10 ft. and so arranged that the cars can be run inside of the building for charging or they can be run out and charged under the yard cranes. The annealing oven is fired with natural gas, although provision is made for firing it either with oil or soft coal.

General Remarks.

The foundry superintendent's office is located at one end of the foundry building under the sand storage shed, and is elevated at such a height that the superintendent can over look the entire floor.

All of the material used and steel made is analyzed by the chemists, and the chemical laboratory is located at one side of the foundry yard. This laboratory is equipped with all of the necessary apparatus, including power grinding machinery, power stirring and shaking machines, hoods for carrying away fumes, and everything that goes to make up a handy laboratory equipped for quick and accurate work.

MOLDING MACHINES AND THEIR USES.*

BY E. H. MUMFORD, PHILADELPHIA, PA.

I have chosen for my title "Molding Machines and Their Uses." It is not my purpose to describe or to advocate any particular molding machine to the exclusion of any. There is use for all. If there is any trade under the sun to which it is impossible to adapt one single machine, or one mechanical process, it is that of molding for metal castings, from patterns as chaotic in outline and dimension as are the brains that originate them, in the one material of the universe, which, from scriptural times on, has been the symbol of instability and fickleness.

When the molding machine art shall at length be finally and fully developed, it is probable that the aggregation of machines responding to its demands will be similar to the

*Paper read before the A. F. A., at Indianapolis, June, 1904.

disarray of flasks, core arbors, bottom plates, and other bric-a-brac of the foundry of antiquity; and I venture to suggest that some of the machines now heralded as world beaters, and bolstered by everything except success, will be relegated to the stacks of brilliant ideas which, then as now, will occupy dusty and unmarked graves in foundry yards, their fast disintegrating skeletons protruding.

Some things are called molding machines which almost lack the number of parts to comply with the definition; for instance a snap flask and the usual match, with vibrator frame and a vibrator, is the most universally applicable hand molding machine for small work that I know, yet all that has been added to the flask and the match to make this apparatus a machine is practically one piece, which need not weigh more than six or eight pounds, so far as its operation is concerned. From this to some of the elaborate process machines, which have been developed for molding specialties, the side bays of the foundry are lined with mechanisms, the mere naming of which would make a paper by itself, and yet the field of molding in sand is not more than half explored; and, as one man has put it, the surface of the trade in molding machines has hardly yet been scratched. When it is ploughed, and sown and fertilized, with an intelligent appreciation of what the molding machine can accomplish, and the energy to make it accomplish this, the resulting crop will keep the molding machine factories busy as they never have been; but no one machine will do the ploughing, nor will one man's brains conceive all the machines that will be required.

I make no attempt to illustrate molding machines, for the reason that it evidently would be impossible to illustrate all, or even the types of them; and, in the remarks which follow, I do not mean to refer to the well known special machines which are used for molding such things as cast gears, pulleys, bath tubs, water pipe, etc., for which the machine is built around its work, and in many instances consists largely of the patterns and their special arrangement, as in the case of a pulley machine adapted to molding pulleys ranging in size from, perhaps, 10 inches to 30 inches on the same machine with every conceivable width of face in these diameters, on which the patterns represent, probably, two-thirds of the weight and nine-tenths of the cost of the total machine.

As I have said, the simplest hand molding machine I know is the vibrator frame, with its vibrator attached guided in the pins of a snap flask and used in connection with a match of the ordinary description, whether of wood, metal or a litharge mixture. In such a frame any two part pattern, which would ordinarily be molded in a snap flask, may be fitted and rammed up, cope and drag, by hand. For a flask say 12 in. x 16 in. the total weight of this machine is not more than twenty pounds, including the flasks, and the whole thing can be hung on the wall. Put this with a hand squeezer, and it is still a hand molding machine. Put it with a power squeezer, and it becomes a power molding machine. Strictly speaking, the vibrator constitutes it a power machine, though the ramming is done by hand; but in a foundry where compressed air is piped about the shop (and foundries where it is not are now exceptions) a hose to a vibrator seems hardly a power connection.

Next in point of simplicity, so far as the machine is concerned, comes the hand-ramming stripping-plate apparatus, in which, by many varying forms of linkage, a pattern support is moved vertically, while a frame of some form supports a stripping plate through which the patterns are drawn. The mechanism by which the patterns are manipulated, and the forms and materials in which the stripping plates are made, are now very numerous; and, except for the expense of the stripping plate, and the necessity for attaching the patterns to a separate support, there is no more generally useful molding machine made. By a slight modification in the construction of the last mentioned hand-ramming stripping-plate mechanism, it is possible to use the same machine for either stripping plate or vibrator molding, according to the nature of the work. Thus a man might have a deep spur gear on such a machine, in which stripping the pattern was a *sine qua non;* and, the next hour, he might wish to mold on the same machine a crank or a valve, or a valve wheel, and it could be done by attaching half a split pattern to a flat plate resting on the same support which previously carried the stripping plate patterns, and placing on the frame, which before carried the stripping plate, a flask frame containing the guiding pins for the flask. The special construction referred to in this machine is one which differentiates vibrator machines from machines on which vibrators might be used by attaching them to one part or another of the machine, but by which attachment the flask and the mold itself would be as much agitated as the pattern which alone one wishes to affect. This construction, which is fully protected by patents, consists in an independent and elastic

support for the pattern, so that this vibration does not extend to the sand, which would otherwise be more or less demoralized in the pattern drawing.

Perhaps, as I have begun with the simpler machines, it would be well to speak next of the "squeezer," as it has been known for years. These machines are so well known and so much in evidence everywhere, and have been for so long in use, that it is hardly more than necessary to mention them. We have all seen the evolution, which it took years to effect, in these squeezers, changing the relatively inefficient side lever, nearly vertical in ramming, to the almost ideal horizontal lever, which even a lazy man can make work by sitting on it.

These squeezers have been fitted with auxiliary apparatus, such as stripping plates, flask lifters, variable tucking blocks, and sprue cutters *ad libitum*, until the hand squeezer equipment seems to have been as intelligently treated as any in the molding machine business. It is not a far step from pulling a lever by hand to making a cylinder do it, and there are now forty or fifty machines in existence in which the operator "presses a button" with his hand and rams the mold, and then presses another button with his knee and draws the pattern. Not more than half the patterns in use may be economically molded by machinery without rolling the drag flask over, and stripping plate and vibrator, hand and power machines of many forms are now made to do this. When a pattern is drawn up there is less excuse for a stripping plate than when a pattern is drawn down, and with four powerful vibrators acting on a follow board, deep and difficult "blind lifts" are easily made.

When stripping plates are used, they may be operated by the machine or they may be left to follow the sand by gravity. Gravity stripping plates are very old, but now and then they are re-invented, much as a new house is made out of an old one by a coat of paint. If the color is sufficiently startling, you forget the old house for your amazement at the new. It is nearly twenty years since a thoughful foundryman jar-rammed the first mold mechanically, and it will not be long before most of the deep machine molding now being rammed by hand is jar-rammed by machine.

I have but skimmed the surface of a wide new landscape, calling attention to a few prominent objects in a "bird's eye view" of the new territory of the molding machine. Foundrymen are watching keenly the development of this, to many of them, yet undiscovered country. They have money to invest; they see wonderful products of the region and wonder what they need to cure them of the tired feeling we all suffer when we see that others are enjoying what we miss.

It is related of John Ericsson that he did not allow physicians to prescribe for him. He would use the doctor's answers to his questions to diagnose his own case. Then, with the entire pharmacopeia applicable to his case symptomatically labeled by the learned man, Ericsson helped himself to his remedy. So, let me suggest that when you feel that you are suffering from what I might call mechanical prostration, you call in the open minded practitioner with no hobby to ride and quacking no patent medicine a cure for all your ills, see what there is to choose from and, diagnosing your own need, make your own selection of apparatus.

Regard whatever money you spend for the purchase of molding machines as only the beginning of your investment. The cost of fitting the patterns to the machines comes after that, and you should not so order your machines as to be obliged to fit your patterns in only one way, and that perhaps the most expensive and most limited in application. Anyone can buy molding machines. Few use them to the best advantage. Nothing is doing more to develop the mechanic in the foundry foreman than the molding machine, and the success or failure of either today marks the use or fall of both in foundries which should use machines.

MOLDING MACHINES OF TODAY.*

BY HERBERT M. RAMP, SCHENECTADY, N. Y.

There is probably no question of greater importance in the foundries of today than the use of molding machines, and their adaptability for use on different classes and grades of work. They have become a fixture, and a part of the equipment of the iron foundry that is both necessary and essential for the cheap and rapid production of castings. No foundry can afford to neglect their use in some form if it expects to compete in business. And furthermore it is not the intention in this brief article to discuss ancient methods or practices, but to try to show what developments have been made in the molding machines of today over those of a decade of years ago.

Dating back probably one hundred years, or close thereto, the first attempt to aid the hand work of the molder was the stripping plate

* Paper read before the A. F. A., at Indianapolis, June, 1904.

device, which has held its position in the trade to some extent ever since, but it cannot be truly called a molding machine any more than an ingenious arrangement of flasks, follow boards or patterns can be. It is simply a device given to the molder to assist in a safe and rapid manner the drawing of the pattern. But its use has been multiplied, and it has been attached to many other molding machines as an accessory to the greatest economy in production.

Following upon this came the question of disposing of the hard labor of ramming up the molds, which in plain or ordinary castings is the most serious item in limiting production, and power rammers of various types were constructed to meet this requirement. They have been operated by all kinds of power—friction, steam, compressed air, and hydraulic—but it is safe to assume that the hydraulic and compressed air machines lead the procession. The market today holds a number of machines of these types that have been well proven.

From this point it was only a step to apply the stripping-plate arrangement to the power ramming machine, which makes a combination that in some instances is very valuable. But the ramming of molds by power, if only one device is used, is applicable to more classes of castings than the stripping plate device.

The stripping plate machine means expensive patterns and absolutely accurate equipment to realize its true value, but the power rammer can be used on any kind of pattern, iron or wood; if it is irregular in shape it can be fitted to wooden follow-boards at one-twentieth the cost to fit up on a stripping plate machine. With the so-called stripping plate machine it costs from one-quarter to one-half the value of the machine to fit up every set of patterns, while with the power rammer twenty to thirty sets of boards can be fitted up for the same amount, with an equal or greater saving accomplished through the function of power ramming than the finely finished pattern. For this reason it is more valuable for general work, where the patterns are apt to be changed or where only a few of each are required.

The power rammer removes the hard and laborious part of the toil, and fits the operator to produce more castings, while the stripping plate machine simply assists in making a perfect casting and getting a perfect draw. Each has its field and its benefits, but the power rammer unquestionably will save more dollars and cents on the average grade of work than the stripping plate device, besides being far more economical to equip to receive the return from the investment.

Further than this, the loss in castings made on power ramming machines is a great deal less than the loss on stripping plate machines, for a power rammed mold will be rammed more evenly and uniformly than it is possible to ram by hand, with the consequent result that the castings will be true to the pattern and not so subject to scabs, swell, and blows. The old narrow-pointed rammer is kept away from the pattern.

Again, the power ramming machine does not require the bars in the flask and the "tucking" of the same, and the setting of endless gaggers and nails that a hand rammed mold does, unless the flask be very large; for the mold can be pressed so much harder than it can be rammed and pressed in that part of the mold where no ill-effects will be felt. The power rammer, with the various attachments, stripping plates for very complicated pieces, vibrators for plainer ones, can be operated with a less intelligent class of labor than the hand ramming machine alone.

There are two distinct types of power-ramming machines built and on the market today. One that rams with a blow; the other with a pressure, or squeezer. On small flasks there is very little to choose between them; both appear to do the work equally well, but on flasks over 20 inches square there is absolutely no question as to the superiority of the machine that rams with a squeeze over the machine that strikes a blow. The reasons for this are obvious. When a flask reaches a size greater than 20 inches square, or 24 long, the power that is required to ram it is enormous, and the jar that the flask and pattern must sustain is too great, unless heavy equipment is prepared. The flasks will spring, or the pattern, if it is wood, will be forced out of shape by the sudden shock, and when the pattern is drawn it is about an even chance that the mold will fall out when the tension is relieved. With the steadily applied pressure or squeeze these conditions do not obtain. Then, with the blow there is no way to determine how hard you have rammed a mold until it is lifted off, but with the squeeze a gauge can be located directly before the operator's eyes, and he can press the molds exactly with the same pressure every time, and with the pressure that experience has taught him as necessary for cope or drag.

Another point of equally great importance

in this connection is this—the machine that rams with a blow when the flask passes 20 inches square in size must be fitted with bars. Otherwise the shock or repeated blows disturb the packing of the sand, and will cause the mold to fall out. With the squeezer the size can be extended up to flasks 30 × 48″, and used without a bar in them. This is an advantage not to be despised.

These things, taken together with the fact that it takes less power to operate a squeezer than it does a machine that rams with a blow, especially if more than one blow is used (and the writer has never witnessed a 36 × 36″ blow machine ram a flask with one blow), constrain me to say that the steady pressure or squeeze for molds over a certain size is a thing not only to be desired, but in every way preferred.

On the small power machines the use of the vibrator is unexcelled, and nearly every casting made on a stripping plate machine can be made equally as well with this device, but on the larger machines the question of some facility to draw the pattern is not of great importance, for the time consumed in drawing a pattern that is only used five or ten times a day is a very small item, indeed, against that where a pattern is drawn from 50 to 200 times daily. The vibrator has its field and holds it, but its field does not extend to large patterns or to large machines.

Of the squeezer type there are two machines to my knowledge on the market that even go farther than all the rest. The time consumed in pressing a mold is very short, and nine-tenths of the time a machine stands idle while the operator is performing other necessary functions. With this in view several machines have been designed so that two or four gangs of men can use the same press; the molds enter from the four corners or the four sides. In this way one expenditure for a machine will represent two or four times the output of the one gang type.

Many machines for special work have been equipped still farther with labor-saving devices. Some have been built with hoppers over them, with conveyors to carry up the sand and discharge it into the hopper, so that the operator can fill the flask in an instant. Trolley tracks or light cranes have been placed over the larger sizes to handle the flasks, both empty and finished, to pour off with, and a number of other simple devices. The machines have made records which appear almost impossible.

The writer does not feel that there is any limit to the size the power ramming machine can be built and operated successfully. It is simply a question of building the flasks strong enough and of fitting the bars into them in one of several ways. It is my belief that the future will see us building molding machines to squeeze flasks five and six feet square as a very ordinary proposition.

Farther than this I believe that the variety of sand handling appliances will be multiplied, and that more machinery and more labor-saving devices will be introduced into the foundry during the next ten years than have been in the past hundred.

The writer offers these few suggestions, from his experience in having charge of a foundry that operates 60 power ramming machines, from 12 × 13″ to 30 × 48″ in size, and 50 stripping plate machines from 12 × 12″ to 42 × 84″, all in operation.

SOME NOTIONS.

BY JOHN F. BUCHANAN.

In most foundries there are peculiar devices which are used in preference to appliances of the regulation pattern, and sometimes with far-reaching effects. For the most part these novelties or improvements have originated with the molder in difficulties. Your business man, scholar or politician can always look to his associates for sympathy or assistance in a dilemma, but the molder—impossible! No two agree about the temper of sand, and no one thinks another wiser than the next; therefore, when luck is against him, he retires from the vulgar gaze and meditates on what might have been, if—. Who can say what benefits have accrued to foundry practice from that meditative If? Foundry tools are not always used for the purpose for which they were primarily designed; the average molder has the bump of adaptiveness well developed. He has also a genius for making use of odds and ends. Observe his swab pot, or his parting sand dish; also how he disposes of his finishing tools on his sand heap or about his person. A molder has the knack of using a shovel for many purposes besides shoveling—as a hatchet in splitting soldiers; as a lever to help turn over a flask; as a pegging rammer with the handle next the work; as a glimmer to keep the heat or glare of metal from hands and eyes; as a gauge in digging a hole; as a measure in proportioning the parts of core sand; as a bott in stopping a run-out; and so on. That is why the term "molder's shovel" implies a strong serviceable implement, and many knowing tradesmen outside the foundry, who could not

tell a cope from a crowbar, know the virtue and endurance of the said shovel, and use no other. It is a common saying that the molder may be known by his shovel, meaning, thereby, if it is sharp and clean, the castings are likely to be in the same condition. But I would not consider a man who gave much time to the condition of his shovel, unless the castings also were attractive.

I have seen a pair of chain slings used for hauling the carriage from the stove (core oven), holding a core in position during the cast, or tying the parts of a loam mold together in addition to being put to all the legitimate uses of a chain and all the special uses of a sling.

Again, where the ordinary screw clamps were too narrow, I have seen a mid-part (intermediate part), slipped over a mold to bind it for casting, chocks being driven in to fill up the space between the shroud or mid-part and the flask, or mold.

We are all familiar with the casting of wrought iron staples, or bridges into adjoining bars near the center of the top half of a pipe box (flask) as shown at AA, Fig. 1. These staples will be found very convenient in setting chaplets.

The side hooks sometimes hinged on stove plate flasks, as shown in Fig. 2, serve two purposes. They save the cramping of the flask for the turn-over and its weighting down for the cast.

Flask pins having slots so they can be secured by a cotter are also used to bind the cope and drag of flasks together, as in Fig. 3.

The advantage of leaving openings in the top halves of shell patterns for convenience in ramming up the core is obvious, as shown at AA, Fig. 4; also the use of cast iron plates (generally about 1¼ inches thick), for weighting down light snap flask molds while they are being poured. Fig. 5 shows one of these weights suitable for pouring sheaves.

These little conveniences are pretty well known in the foundries, but some of them, so

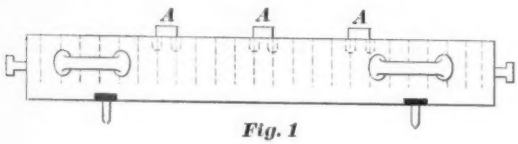


Fig. 1

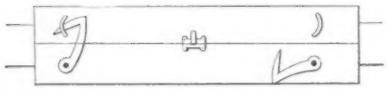


Fig. 2

Fig. 3

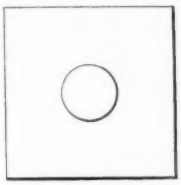


Fig. 5

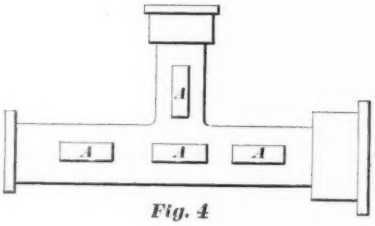


Fig. 4

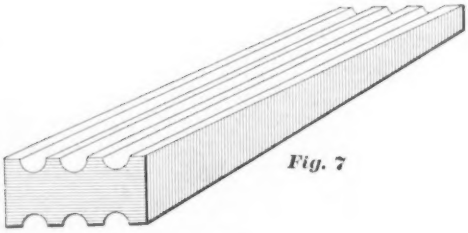


Fig. 7

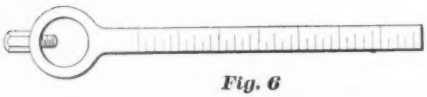


Fig. 6

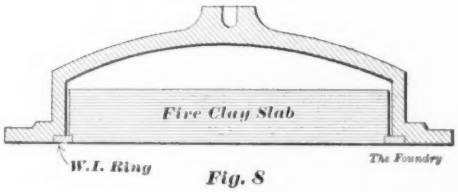


Fig. 8

far as I know, have not been honored in print. Molders are proverbially shy and unassuming. Probably you thought such trifles were unworthy of being put on record. That is your mistake, and if this hurried sketch should give rise to a crop of "good things I have seen in the foundry," in all likelihood you would be first to admit the same.

The following improvements on some well known foundry appliances were the result of necessity in the writer's experience. Fig. 6 represents an ordinary shear iron (sweeping arm) with a graduated scale along its top edge. It is frequently necessary to run up a seating or a cope for a loam mold with standard sweeps. Much time is taken up in setting the board to the gauge stick. When the radius is laid off along the top of the shear iron, as shown, this difficulty is avoided, and the board can be set instantly to any required diameter.

Oftentimes circumstances dominate the efforts of the molder in his attempt to produce perfect work in such a way that he has, perforce, to acknowledge the advent of the unexpected. This idea is not new, but it branded itself upon me at a very inconvenient moment, —the moment of reversing the gear ladle when a job was newly cast. The job was a propeller blade in loam. It had been bound in the usual way and was duly inspected by the boss before being surrounded with curb plates, rammed up and otherwise prepared for casting. Just as the mold was filled the boss was in the act of making his customary comment on these occasions ("another be-u-tiful cast") when the metal in the head and risers disappeared quietly and unostentatiously, without warning or explanation. My mate endeavored to probe the mystery with his feeling rod, but he was only able to discover what I already felt in the region of my left ventricle—a vacuum. Later on seeking for the cause of the difficulty, we unearthed a disreputable looking wedge, lying alongside the mid-off binder. I had reason to know that wedge; it skidded when I was getting it home the first time, and I had to put my fingers in my mouth to keep myself from saying things. It was the last straw—I mean the last wedge, which the archives of the foundry could furnish, and now as my eye again caught sight of it, I found myself trying to repeat the same words. Fortunately for me, the boss took the credit of this "be-u-tiful cast" and I, remembering my bruised finger, took refuge in an obscure corner, while he relieved his feelings. When night came, I put on my thinking cap—I mostly do when the unexpected happens. My wife said I was not fit company for anybody. She wanted to know if the furnace had been "scavenging" (*sic*) again, etc. Under the trying conditions—answering irrelevant questions and digesting a problem, I evolved an improvement in foundry wedges, which is shown in Fig. 7. These wedges consist of malleable castings having grooves running the entire length, thus giving an increased grip and making a decided improvement over either the forged or cast wedges.

Another little improvement which adds greatly to the convenience of handling crucible covers and furnace doors, is shown in Fig. 8. The ordinary door for this purpose is a square or circular cast iron plate ribbed on the top side with a central lug for lifting or slinging it into position. This form of cover becomes distorted very soon. The one shown in the illustration consists of a cast iron dome enclosing a fire clay slab kept in position by a wrought iron ring held in a recess by countersunk screws. The arrangement is applicable to furnace doors hung either in a vertical or horizontal position. The initial expense is little, but the fire clay slabs should last from one to two years. The mold for a circular dome can be easily struck up in green sand with a couple of strickles, thus saving the cost of a pattern.

THERMIT REACTIONS.

In the November number of *The Foundry* we had a description of the exhibit of the Goldschmidt Thermit Co., at St. Louis, in which we said that they had some pure alloys made in their electric furnace. This we find is a mistake, as the alloys are produced by their aluminogenetic process, that is, by the reaction of finely divided aluminum on the metallic oxides of different metals. Alloys produced in the electric furnace always contain more or less carbon, while by the aluminogenetic process it is possible to produce metals free from carbon, as the intensity of the heat precludes its presence in the metal. In the electric furnace it is impossible to distribute the heat evenly through all portions of the bath, while by the above mentioned process every particle is brought to a uniform temperature.

THE FOUNDRY.

PUBLISHED MONTHLY BY

THE PENTON PUBLISHING CO.

CLEVELAND, OHIO.

CHICAGO: 1164 Monadnock Blk.,
PITTSBURG: 429 Park Bldg.,
NEW YORK: 150 Nassau St.

The subscription price of THE FOUNDRY is $1.00 a year to points in the United States, Canada and Mexico. To Great Britain: Eight shillings. Single copies 15 cents.

Practical articles pertaining to the trade in all its branches are solicited and will be paid for.

Entered as second-class matter at the Post-Office at Cleveland, Ohio.

CONTENTS.

Steel Foundry of the Wellman-Seaver-Morgan Engineering Co. 201
Molding Machines and Their Uses 205
Molding Machines of Today 207
Some Notions 209
Thermit Reactions 211
Trade Outlook 212
Cost Keeping and Good Times 212
Casting Brass Liners on Propeller Shafting 213
Visiting a Foundry 213
Molding Machine Practice 214
By-Product Foundry Coke 217
A Dismal Swamp Foundry 220
Aluminum Thermit Exhibit 221
Radiator Pattern Costs 222
Shrinkage Troubles and Methods of Feeding 225
Fan and Positive Blower Tests 229
Smart Work in the Old Country 235
Cast Iron Notes 236
Brass Foundry Notes 237
Casting of Silver 237
Steel Foundry Notes 238
Associations and Societies 240
Charters of Local Foundry Foremen's Associations 243
Fluor Spar in the Cupola 243
Points for Brass Founders 245
Personals 246
Deaths 246
Fires 247
New Construction 247
General Industrial Notes 248

TRADE OUTLOOK.

In the December number of *The Foundry* we were able to report not only an advance in the price of pig iron, but a general picking up of foundry work throughout the country. As is usual on a rising market, users of pig iron have been anxious to cover their future requirements at as low a figure as possible. The result is that most foundrymen have placed orders to cover for the first quarter. The furnaces also are sold out pretty closely for the first quarter. Very little second quarter's business has been done, however. The past month has seen advances in a number of lines of finished products, especially in bars, rods, wire, sheets and structural shapes. When the contracts for castings for the coming year are made, there will naturally have to be a readjustment of prices along this line. No. 2 Southern foundry iron is firmly established at $13.50, and the corresponding Northern brands have advanced to $16.25 or $16.50 at the furnace. There are also a great many more inquiries being received for molders, foundry foremen, and other foundry employees, showing that the foundry business is picking up. The reports from various foundries throughout the country also show that a considerably larger number of molders are now at work than there were a month ago.

As an indication of future foundry work, it is interesting to note that as a rule the patternmakers throughout the country are very busy, many pattern shops having increased their force recently, and in some cases they are having difficulty to find as many good workmen as they desire. As the patterns being made mean future foundry work, this is certainly an encouraging symptom for the foundrymen. The foundries making rolling mill machinery are especially busy.

COST KEEPING AND GOOD TIMES.

Editor of *The Foundry:*

I have read with interest the article in your December number entitled "Cost Keeping and Good Times."

To one reference therein, that of the "Cost per ton for fixed charges," I beg to state that my conception of it, so far as it relates to estimated individual costs, is at variance with your own and correspondents who have contributed to your valued journal at different times. This is especially true in reference to jobbing shops doing both heavy and very light work. It is my conception of the proper man-

ner of distributing this element of cost, viz., interest, official salaries, watchman's wages, insurance, taxes, coal, etc., that it should be equally apportioned to the number of molders employed in very nearly equal amounts.

For example, if these annual fixed charges have amounted to $10,000 per year and the total number of molders' floors "worked" is 9,090 annually, then the charge against each day's work of one molder should be approximately $1.10, irrespective of the weight he turns out. For instance, if we have one molder casting a lathe bed in one day weighing 1,000 net pounds and another molder turning out a very light gate of castings, the total production of which, for one day, is 100 pounds, it would follow that under the method of apportioning fixed charges per tonnage, with a basis of $4 per ton, the lathe bed would be burdened with $2 of fixed charges and the 100 pounds of light castings with but 20 cents.

My idea of this is that both should be burdened with nearly an equal amount, viz., approximately $1.10 each, as it has surely not cost ten times as much insurance, taxes, watchman's wages, etc., to produce the lathe bed as it has the day's production of light castings.

If this subject is of interest to your readers, I should be pleased to hear comments on the subject. "A. B."

Note by the Editor: We fully agree with the writer of the above and believe that some such system would be a better method of distributing the costs. The article to which reference has been made was intended primarily to bring out the necessity for some cost keeping system and we are very glad that this phase of the subject has been emphasized.

Casting Brass Liners on Propeller Shafting.

BY C. VICKERS.

In casting brass on iron there is one thing that I have noticed; it may not have escaped other people's notice either, but I have never seen it mentioned in any of the interesting articles on the subject that have appeared now and again in *The Foundry*.

What I have noticed is that molten bronze has a violent antipathy to iron oxide. The least bit of oxide will cause a surprising amount of gas and commotion inside the mold, when the brass reaches it. This is what causes blow holes. Take the humble soldering "iron," for instance,—to drop from the sublime to the ridiculous,—the copper heads are often cast onto an iron handle. At one time I cast large quantities of them; the handle was only one-fourth inch diameter, but they invariably "blowed" when cast with irons cold, and sometimes when heated. But when we tried a low grade steel rod, that was smooth and had a copper coated finish, instead of an oxidized one, the blowing ceased and heating the irons became unnecessary.

I had some trouble with a liner myself some time ago. When pouring it I, of course, "flowed off" considerable brass, and the casting looked so fine I was proud of it, but it came back, like the cat, and I was amazed to see what a number of blow holes could hide themselves beneath the skin of one brass casting. Amongst the blow holes and sticking to the brass I noticed thin black scales of iron oxide, and I knew why the bronze had been so insulted it had objected to the iron so strenuously. The shaft had been oxidized while being heated, and the oxide stuck so firmly it defied the steel scratch brush, and would never have been noticed if not specially looked for.

In this case I cleaned the shaft by filing, recast it as before and was completely successful.

Now, I do not wish to be understood as saying that the removal of oxide will always ensure a successful liner casting, for there may be other causes for such defects, but it will certainly help, and is therefore a step in the right direction.

Visiting a Foundry.

In connection with one of the New York public schools a novel feature of instruction has been tried. The pupils from School No 111 in Brooklyn, recently visited the foundry of the Brooklyn Foundry Co., in Brooklyn. They were accompanied by their teacher, Miss Maud A. Read, and at the foundry were met by the officers of the company, who took the forty children through the works and described the various points of interest to them. They were shown the melting and pouring of iron, but their greatest interest was in the brass foundry, on account of the fact that the brass tablet for their school was cast there.

They saw several bronze tablets for public buildings now in course of construction, after which they visited the pattern department, plaster and modeling department, and then returned to the school. It seems as though such trips as this, if carefully planned and properly conducted, could be made a very interesting and useful part of the education of our public schools.

MOLDING MACHINE PRACTICE.

BY F. W. HALL.

The following description covers the molding of a cone pulley 5 inches in diameter. There are two ways of mounting small cone pulleys on a molding machine. The pattern may be split in two and the halves of it mounted on each side of the center line of the pattern plate, the pattern being provided with a coreprint. This method necessitates the making of a core box for coring out the inside of the pulley.

In order to avoid the making of this large and frequently complicated core, the other method of mounting will be described in this article. This of course requires a short stock core for making the opening through the hub, but no special core box is required. The core for the inside of the pulley is formed of green sand during the molding process. This method of mounting the pulleys is more expensive than the other, but once it is done, there is no constant expense for the making of cores. The pattern for the pulley is shown in Fig. 1, and in Fig. 2 is shown a front view of a Paxton Hall Duplex split pattern pneumatic molding machine, with a special roll over device for the drag. In Fig. 3 the same machine is shown, with the ramming block swung to one side, and the flask broken away to show the details of mounting the pattern. The flask used is an 8-inch by 15-inch with a 5-inch drag and 3-inch cope, both being rammed at the same time with one head block. The patterns are so mounted that they are drawn simultaneously by means of compressed air working in the lower cylinder shown in Figs. 2 and 3.

By the use of the roll over device the mold is completed and put together as shown by the dotted lines on the right of Fig. 3, before it is removed from the machine. This enables the workman to carry the entire mold to the floor with only one trip, where two are necessary in most molding machine operations. It will be seen that this will save a great deal of time. The mold is arranged to make two pulleys at a time. The drag pattern plate is shown in detail in Fig. 4, and the cope pattern plate in plan in Fig. 5 and in section in Fig. 10. The plan and sectional view of one of the stripping rings for the drag pattern plate is shown in Fig. 6 and the stool post for the same in Fig. 7. The stripping plate for the cope pattern plate is shown in Fig. 8, with one of its stools below it. The sprue pin used for this work is shown in Fig. 9. A sectional view of the cope pattern plate with the rings, stools and weights assembled is shown in Fig. 10.

In mounting the patterns the cone pulley pattern should be taken first and finished all over to the proper shrink measurements. The drag section can be made of hard wood, brass, or iron, but the cope section should be finished as part of the pattern plate, as shown in Fig. 10. The plates shown in Figs. 4 and 5 are finished ¾ inch thick, 7 inches wide and 14 inches long, all surfaces being finished. They are then drilled with the use of a molding machine jig to fit the top frame of the machine. Center lines should then be scribed in both directions across the plates. The cope pattern plate shown in Fig. 5 should then be clamped to the face

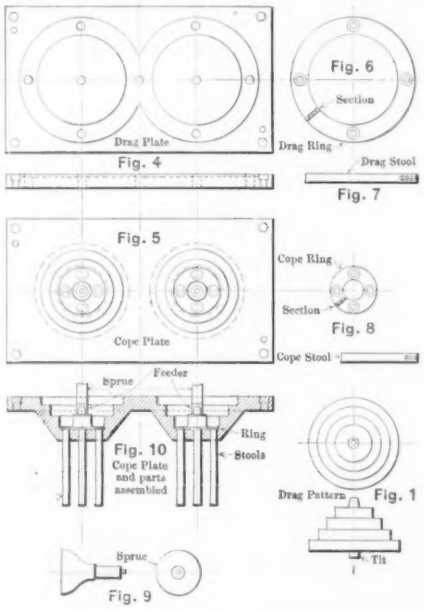


plate of a lathe, true with the center of the desired location of one of the cope patterns. This center should be 3½ inches from the intersection of the center lines and located on the center line running lengthwise of the plate. After the plate is properly located, the pattern or pocket in the plate should be finished to the desired size of the inside of the pulley, the necessary shrink allowances being made. In the bottom of the pocket a recess should be turned to receive the cope stripping ring shown in Fig. 8. Before removing the cope plate from the lathe, a half-inch hole should be drilled through the plate in the center of the pocket. This half inch hole is for locating the core print and it is also used to locate the center of the pattern on the drag plate. After

the first pocket has been completed, the cope plate is unclamped from the face plate of the lathe and shifted so as to bring the center of the other pocket in line with the center of the lathe. This pocket will of course be 3½ inches on the other side of the center of the cope plate and upon the longitudinal center line. This pocket is finished in the same manner that the first one was.

After the cope plate has been completed, it is removed from the lathe and set on top of the drag pattern plate having the top surface of each in contact. Dowel pins are now used to locate the plates properly, and they are clamped together. They are then taken to the drill press and a half inch drill run through the holes corresponding to the center of the patterns in the cope plate. These holes are drilled clear through the drag plate and will serve to locate the drag patterns accurately. After the holes are drilled, the plates are separated and the drag pattern located. If the drag pattern is made of wood, it would have a tit on the flat surface to enter a half inch hole and if made of metal, it would have a half inch hole through its center. In this case the cope print would be made with a half inch rod upon it long enough to pass through the pattern and into the hole in the drag pattern plate. Next, locate the drag patterns either by means of the tit or by the rods extending through them and into the holes in the drag plate. Scribe the outline of the largest step of the cone on the pattern plate, then remove the patterns and place the drag pattern plate on the face plate of a lathe, clamping it so that one of the half inch holes will be in line with the center of the lathe. Then turn out a groove in the plate ⅛ inch deep and true with the scribed outline of the outside diameter of the pattern. This groove must be of such a size that the drag stripping ring shown in Fig. 6 will fit it accurately. In like manner turn out a groove for the other pattern and then remove the plate from the lathe, take it to the drill press and drill four ½-inch holes in the center of each groove, clear through the plate as shown in Fig. 4. These holes are for the stools shown in Fig. 7. Place the rings in the grooves and scribe the outline of the four holes on the under side of each ring. Before the rings are removed from the plate designating stamps should be placed upon them and upon the plate, so that they can be returned to exactly the same position in the plate. When the grooves in the plate run into each other, as shown in Fig. 4, it will be necessary to trim off the edges of the stripping rings so that they will meet along the transverse center line of the plate, or both rings can be formed from one sheet of metal joined in the center. This will increase the work of making the rings, as it will necessitate the finishing of the outside of the rings by filing.

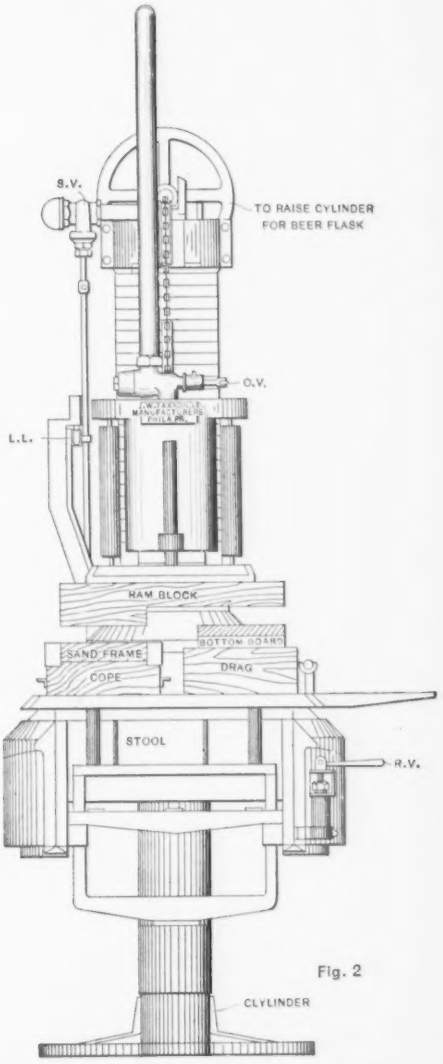


Fig. 2

After the holes have been laid out on the under side of the rings a tap hole should be drilled through each ring in the center of the circles scribed through the half-inch holes and these holes should be used to locate the holes in the top end of the drag stools. The stools should then be drilled and tapped, a body drill run through the holes in the rings, and the upper surface of the holes countersunk. The

stools can be made out of pieces of brass rod cut to the proper length and the rings can be made out of sheet brass. Eight short pieces of cold rolled steel one inch in diameter and one inch long should next be taken and a half-inch hole drilled through the center of each of them. A hole should also be drilled in one side of each and tapped for a set screw. These are to be used as weights upon the stools to hold them down. As all the parts for the

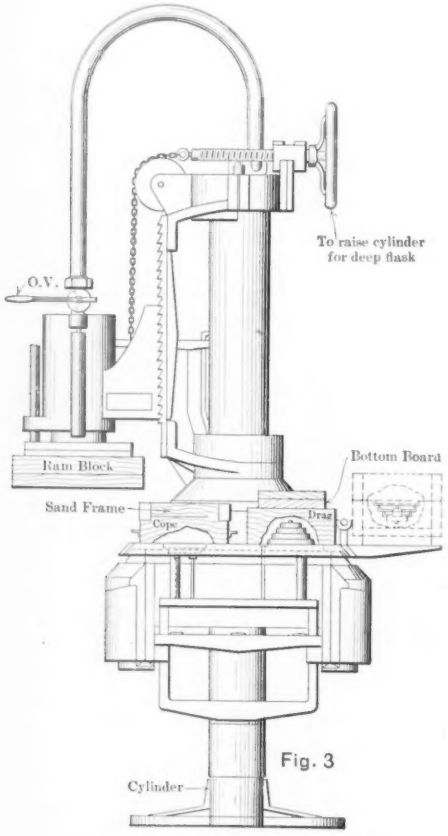


Fig. 3

drag plate patterns are now complete, they can be put in their place upon the right of the machine, as shown in Fig. 3.

The cope plate has already been finished to the size and shape as shown in Fig. 5, and a groove turned in the bottom of the pocket to receive the stripping rings. These stripping rings are necessary when drawing the patterns from the sand, to prevent the sticking of the sand in the bottom of the pocket. In these cope rings are drilled four ½-inch holes similar to the ones in the drag rings, and the stools fitted up in a manner similar to that described in the case of the drag plate. The stools for the cope rings are shorter than those for the drag, on account of the fact that the cope pattern extends down into the cope plate, as shown in Fig. 10. A taper core print should next be made for the cope pattern plate and the taper end should be made ⅛ inch longer than the core print of the drag pattern, so as to insure clearance in the mold when it is closed. A ¼-inch hole should be drilled in the center of the core print, clear through it from end to end. This hole is for locating the sprue shown in detail in Fig. 9. The reason for drilling the hole clear through it, is that if any dirt accumulates in the hole it will fall through, thus keeping the hole free. Three feeders should next be filed up from brass, and screwed or riveted to the taper core print, as shown in Fig. 10. This completes all the parts for the cope pattern plate and they should be assembled in their respective places on the machine, as shown on the left in Fig. 3. As the cope and drag pattern plates slip into place on the machine, they are automatically connected with the pneumatic vibrator or rapping engine, one vibrator serving to rap both plates.

For the flask take an ordinary snap flask and fit it with special round pin flask fittings to fit the holes in the top frame of the machine. Make a sand frame for the cope flask. This frame should be 1⅛ inches deep and of the same size as the inside of the flask. On each corner of the frame screw a piece of square root angle iron 1½ inches long. This will leave ⅜ of an inch of the angle iron projecting down below the lower surface of the frame which will locate the frame properly on top of the cope. Make the proper number of bottom boards for the drag flask, the number corresponding with the number of molds to be put up in a day. These boards should fit inside of the flask and should have two cleats running across them and so located that they will rest upon the brackets extending from the left of the machine when the flask is rolled over, as shown by the dotted outline on the right of Fig. 3. The ramming board for the machine should be made as shown in Figs. 2 and 3. This board is fastened to the end of the plunger, and on the left is provided with an extended piece 3-16 of an inch smaller than the inside of the cope portion of the flask. The two parts of the ramming block should be so arranged that when the right hand portion is touching the cleats on the bottom board, the left hand portion will be in contact with the sand in the sand frame upon the cope portion of the flask. A little experimenting may be

necessary in fitting up this board so that it will ram both parts of the mold evenly.

It is next necessary to make the roll over fittings for the drag portion of the flask. This consists of vertical posts secured to the machine as shown in Figs. 2 and 3, and two projections from the sides of the drag portion of the flask, having pins which will fit in the top of the post and serve as a bearing as the flask is rolled over. This roll-over attachment can be so located that the cleats on the bottom board will come upon the arms projecting from the right of the machine.

In making the mold, the cope and drag sections of the flask are set in place on the machine, the sand frame placed upon the cope section and the ramming head swung to the left out of the way, as shown in Fig. 3. Some facing sand should next be sifted over the face of the patterns, and the flasks filled with heap sand and struck off. The ramming head should then be swung into the position shown in Fig. 2 and with the right hand the operating valve lever O-V should be pushed to the left, which will bring the ramming head down upon the sand. A little practice may be necessary in determining the proper method of ramming the sand. In some work it is only necessary to squeeze it, while in other work it may be necessary to both squeeze and ram or strike it. When the ramming is complete, release the operating handle when it will automatically return to place, closing the air valve and exhausting the air from the cylinder. With the left hand on the locking valve L-L, Fig. 2, the locking pin should be released, which will automatically close the safety valve S-V, Fig. 2. The head should now be swung to the left, as shown in Fig. 3, and with the right hand the vibrator valve R-V, Fig. 2, should be operated. This lets air into the vibrator on the back of the machine. Another turn of this same valve will let air into the lower cylinder at the foot of the machine, the piping for which is not shown, which will lift the top frame of the machine with the flasks and sand off from the patterns, the stripping plates serving to strip the sand off from the pattern. When the flasks are in the uppermost position the drag should be rolled over and the stock core for the hub set. Next lift out the telescoping sprue from the cope and set the cope on top of the drag. The flask is then removed from the mold and the whole carried to the molding floor.

BY-PRODUCT FOUNDRY COKE.*

BY CHR. SCHWERIN, MILWAUKEE, WIS.

The rapid increase in the quantity of retort-oven or by-product coke being manufactured in this country, is the excuse for the following few remarks on the process of its manufacture and its utilization, particularly for cupola purposes.

The process of coking coal in such a manner as to utilize the products of distillation, as tar, ammonia, gas, etc., had its origin in Europe, where, due to the deepening of the mines, the comparatively limited supply, and exhaustion of some of the fields of coking coal, it was recognized that something should be done to economize nature's gifts.

In the ordinary Bee Hive coking process the only product of the coal that is utilized is the residual coke left in the oven after the volatile constituents have been driven off. These volatile compounds simply dissipate themselves into air and all the benefits which might be derived from them are lost to mankind forever. Contemplation makes one marvel at the stupendous amount of energy being constantly wasted —energy which has been stored up for ages— and can never be replaced. The value of this lost material annually amounts to millions of dollars.

In the retort-oven process all these constituents are recovered, and instead of, as some people think, the quality of the coke being injured, it is, on the contrary, superior as a rule. Coals which cannot be made use of in the Bee Hive process often make excellent cokes in the retort oven. In fact, one of the first uses to which this latter type of oven was put was in making coke out of European, hitherto non-coking, coals. On consideration of these facts the conclusion one naturally reaches is that, if a satisfactory coke may be obtained by the retort-oven process why should it not be utilized, and all the valuable material saved which is now being so lavishly wasted.

The first by-product ovens in the United States were those completed in 1892 at Syracuse, N. Y., for the Solvay Process Co. These twelve ovens in 1894 produced 16,500 tons. Since then a large number of plants have been erected and the yield of coke from by-product ovens has increased enormously, amounting to 1,403,588 tons in 1902. Further plants are in process of erection and one of the eighty ovens with a production of 450 tons of coke daily has just been completed in Milwaukee.

*Paper read before the A. F. A. at Indianapolis, June, 1904.

In the by-product process coal is so coked that the gases driven off may be led through suitable apparatus for the extraction of tar and ammonia compounds. After these have been removed a portion of the gas is returned to be turned in flues running between the oven walls, thus furnishing the heat necessary for coking further charges. The remainder of the gas is utilized for generating power, heating furnaces in manufacturing plants, for ordinary household fuel purposes and, in a measure, for lighting, as at the Everett plant of the New England Gas & Coke Co. The ammonia is utilized for making soda, ammonia compounds and fertilizers. The tar is used for the manufacture of coal tar compounds, and for making roofing pitch, tar paper, creosote oil, etc.

The following is a brief description of Solvay ovens, this type being described as the writer is more familiar with it, and with the coke made from the same, than he is with the other by-product processes.

The ovens themselves are rectangular in shape, like a flat box standing on edge; the dimensions vary from fifteen to twenty-four inches in width, five to seven feet in height, and around thirty feet in length. The walls are built of specially fitted brick. The ends of the ovens are closed by doors which work up and down. When these doors are down and properly luted with clay no air can enter the retort chamber.

All heat necessary for coking is furnished, as mentioned previously, by the gases which are burned in flues running parallel with the walls and outside of them. The quantity of gas and the air admitted for its combustion can be easily varied, so that a close regulation of the heat may be obtained, thus enabling the coal to receive a uniform coking temperature. The coal never comes into actual contact with the flame. This is a great advantage over the Bee Hive process.

The coal for charging the ovens is brought from stock piles by suitable conveying apparatus, and dumped into them from larries running above. After the proper quantity of coal has been put into the ovens it is carefully leveled off by hand. Coking proceeds rapidly and where in the Bee Hive process seventy-two hours are considered necessary to produce a strong foundry coke, in the Solvay process a structure equal to the most rigid requirements may be obtained in from twenty to twenty-four hours; in the Otto-Hoffman ovens the time is somewhat longer.

Probably several of the reasons for the structure being more quickly obtained in the by-product process than the Bee Hive, is that coking proceeds far more rapidly and uniformly; also, in the Bee Hive process the layer of coal is only eighteen inches deep, while in the retort-oven process it is from six to seven feet, a feature that tends to compress the coke while it is being produced. In addition, the coal is pulverized before being charged into the ovens, and this helps materially.

After the coal is completely coked, both end doors are raised and the charge is pushed out by an electric ram. As the coke slowly emerges from the ovens a stream of water from overhead strikes it as it falls into a steel quenching car which runs on a track below the oven level. Just sufficient water is added to quench the coke and yet leave it almost free from moisture. By the time it is dumped out of the quenching car the residual heat in the coke is found to have evaporated the excess water.

Before citing results and actual figures of cupola operation in which by-product coke has been used it might not be amiss to mention a few of the prejudices against it that are sometimes necessary to contend with. Here is the way one melter put it: He said to his foreman that if he had to use "that dirty, black stuff" he would quit first. The management insisted that it be used and now the melter swears by it and not at it. Another man said his cupola was too big to use by-product coke and that he did not think it would stand up. He would not make an attempt unless he was guaranteed against all loss which might be occasioned due to the coke. After using it for a while he thought it was just right. Still another superintendent, after the receipt of his first by-product coke, telephoned in that he would not use it unless the coke company's representative took charge of the cupola and guaranteed all loss. This same man, after a trial heat had been run, again telephoned that he had examined all the castings and found everything perfect.

It is a common thing to have by-product coke condemned on its looks and recommended on its work. The manufacturers of by-product coke are working strongly to overcome this natural but unreasonable prejudice, and are continually demonstrating that for foundry use nothing can beat a good by-product coke.

Many foundries have been using by-product coke for years with excellent results. However, it may be interesting to see some exact figures on some very recent tests, conducted

by the writer, of by-product coke from Milwaukee:

Tests Nos. 1 and 2 were run at the West Allis shops of the Allis-Chalmers Co. Test No. 3 was run at a stove plate foundry, and test No. 4 at a shop making a large number of hot air registers of fancy design. As is well known, these are very difficult to run unless the iron is very hot and fluid. These tests were run in competition with exceptionally good grades of Connellsville coke. The speed of melting was in favor of the by-product, also the sulphur was considerably lower than in Connellsville; as is well known, better castings can be produced from low sulphur coke. Another advantage of low sulphur coke is that a larger quantity of scrap may be carried in the mixture if so desired

Those looking over the following figures will please bear in mind that all coke and iron were very accurately weighed. Many a foundryman will find upon investigation that vastly larger quantities of coke are going into his cupola than are ever reported to the office. Very frequently indeed has this fact been impressed upon the writer when conducting comparative tests. In fact, it is only within the past few weeks that it was found that the office of a certain foundry was getting daily reports showing that the melting was being done with from one hundred (100) to one hundred and twenty (120) pounds of coke on a charge. Upon investigation, however, it was found that the usual practice had been to charge from one hundred sixty (160) to one hundred seventy-five (175) pounds. This fact was quite a surprise to the management. The reason the writer brings this point out so strongly is, that when something new is tried it is usually closely watched, and if it is found that a larger quantity is necessary to do the same work than was hitherto thought to be the practice, the new article is condemned, when in reality there might be no basis for such condemnation.

RECORD OF TEST NO. 1.

Inside dimension of cupola..... 72 inches
At melting zone ..... 69 inches

	Lb. of Coke.	Lb. of Iron.
Bed charge	3,300	10,000
Charges No. 2 to No. 26 inclusive	550	5,000
Extra coke used during heat	575	.....
Total.....	17,625	135,000

Time from blast on until first tap, 20 minutes.

Time from first tap until last iron, 3 hours, 40 minutes.

Pounds of iron melted per hour, 36,800.

Ratio of coke to iron, exclusive of bed, 1 to 8.65.

Ratio of coke to iron, inclusive of bed, 1 to 7.62.

The iron was very hot and fluid, hotter towards the end of the heat for pouring comparatively light finished castings.

RECORD OF TEST NO. 2.

Inside dimension of cupola ..... 72 inches
At melting zone ..... 69 inches

	Lb. of Coke.	Lb. of Iron.
Bed charge	3,300	10,000
Charges No. 2 to No. 31 inclusive	550	5,000
Extra during heat...	600	.....
Total.....	20,400	160,000

Time from blast on until first tap, 20 minutes.

Time from first tap until last iron, 4 hours, 30 minutes.

Pounds of iron melted per hour, 35,500.

Ratio of coke to iron, exclusive of bed, 1 to 8.77.

Ratio of coke to iron, inclusive of bed, 1 to 7.84.

Temperature of iron perfectly satisfactory.

Castings poured from these two tests varied from light valves to an engine bed weighing 30 tons.

RECORD OF TEST NO. 3.

Inside dimension of cupola..... 48 inches
At melting zone ..... 46 inches

	Lb. of Coke.	Lb. of Iron.
Bed charge	1,000	2,200
Second charge	110	1,100
Third charge, Fourth charge, Fifth charge, Sixth charge, ...	105	1,100
Seventh charge, Eighth charge, Ninth charge, ..	100	1,100
Tenth charge	130	1,100
Eleventh charge, Twelfth charge, ..	110	1,100
Thirteenth charge ...	110	1,180
Total.....	2,290	15,480

Time from blast on until first tap, 10 minutes.

Time from first tap until last iron, 1 hour.

Pounds of iron melted per hour, 15,400.

Ratio of coke to iron, exclusive of bed, 1 to 10.38.

Ratio of coke to iron, inclusive of bed, 1 to 6.8.

The iron was very hot and fluid. Some very

light and difficult stove castings were run during this heat.

RECORD OF TEST NO. 4.

Inside dimension of cupola	45 inches	
At melting zone	45 inches	
	Lb. of Coke.	Lb. of Iron.
Bed charge	1,350	4,000
Charges No. 2 to No. 6 inclusive	300	3,000
Charge No. 7.....	180	1,800
Total	3,030	20,800

Time from blast on until first tap, 22 minutes.

Time from first tap until last iron, 1 hour, 8 minutes.

Pounds of iron melted per hour, 18,300.

Ratio of coke to iron, exclusive of bed, 1 to 10.

Ratio of coke to iron, inclusive of bed, 1 to 6.8.

Temperature and fluidity of iron were satisfactory.

Three hundred pounds of coke were actually put into the cupola on the last charge in order to take care of a full charge of 3,000 pounds of iron: however, only 1,800 pounds of iron were charged on it.

In looking at these tests it must be borne in mind that no attempt was made to break a record for low coke consumption. In every case the object aimed at was primarily to obtain hot, fluid iron adapted to the work and to get at least as good a ratio as had been customary at the plants where these tests were run.

A DISMAL SWAMP FOUNDRY.

BY DARBY O'QUILL.

There is situated in a swamp within the confines of the temperate zone a plant that for want of a better name the owners are pleased to call a foundry, and a modern one at that. True, a good casting is occasionally made there, but bad ones are invariably the principal product of this highly prized establishment. The place is supposed, in fact advertised, and by some people probably believed to be a large modern foundry, capable of turning out castings up to 40 tons, but as a matter of fact cannot make a respectable one of 40 ounces.

If a large rectangular establishment, with a one-inch hemlock roof, that a fat boy would fall through, a cheap jack 30-ton traveling crane, that could not lift 10, a 10-ton jib crane that was attached to the wall, but pulled out by the roots with a 1,500-pound load, a few dilapidated ladles of fifteenth century design, a cupola constructed after the fashion of a wine bottle, a few iron flasks made of open sand plates, and a couple of dozen wooden ones, well burned and provided with wire spike pin attachments, constitute a modern foundry, then the subject of this sketch is one with a rip and a vengeance.

The writer has been for a number of years sort of stage struck (foolishly perhaps) with modern notions as to modern foundries, and as this one was pictured to his admiring gaze with a glittering array of photographs and the prospect of a fat monthly check, he bade a fond farewell to the old-style jib cranes and the low, badly ventilated roof and hied himself to this promised land to run a modern foundry and its attendant pattern shop. His avowed intention was to cut a wide swath in the market for castings in that particular region.

After taking up my duties as superintendent, I found to my surprise that I was a sort of silent partner in a saloon that dispensed the "essence of crime" and bad lager at five cents per in liberal quantities, principally to the workmen. This queer auxiliary to a modern foundry was walled off in one corner of the shop and was used as a restaurant, rum dispensary and all combined in one, but this part of the equipment was of the same cheap skate style as the rest, for the tables consisted of rough pine planks thrown loosely upon a couple of rickety horses. There was not a stool or chair of any kind in sight, except a couple of 2 x 4 scantlings and a few nail kegs. Being always repugnant to rum in the foundry and making no secret of the same, I knew that I would have no small task to square myself with my old acquaintances. There was a threatened rupture in my relations with some of my well meaning insurance friends, who debar policy holders who are saloon-keepers, and my fraternal society friends threatened to cut my acquaintance altogether, so that in a short time I had almost persuaded myself that I was gradually graduating from a foundry foreman to a saloon-keeper. Some of the molders who are never enemies of a saloon were liable to have a paragraph in the Journal "from a hobo, yes, or a hobo, guess," relating to me as the man who ran a shop where they blew the whistle twice a day in addition to the regular stopping times, so as to give the shop's

crew a fair chance to "can up" and keep in even humor.

I had no chance of maintaining my previous good relations with my friends of the Prohibition faith, so, to square myself, I fired the job, after spending time enough to make myself most decidedly blue.

We have all heard of the modern foundry, with its costly lavatories, metal locker closets, shower baths, hot and cold, etc., but to my mind the saloon is something new, something the engineering profession is not well posted on, but for various reasons the writer wishes to preserve "incog." the originator of this scheme.

Strange to say, the narrow-gauge management made no money by this innovation in foundry business.

As previously stated, the foundry was built in a swamp, a sort of dismal swamp to me. It had no road or driveway for an entrance, its only inlet or outlet being a spur track, over which a trained hobo could make his way with difficulty in wet weather. There was a poor imitation of a New England corduroy road, about 100 yards distant, from which vantage point the occasional weary traveler could view the paper sign "Saloon," on the larboard side of the building, while in his mind he may judge the place to be a new style of beer garden, or perhaps an armory, for on one side are several imitation parapets and on its naked gable a flagstaff, from which it would be a mockery to fly "Old Glory."

The place was one huge clay wash-pot, the depths of which I took good care not to investigate. I know, however, that the mud was so pliant under the foundation that a species of crab known in that region as "crowdad" could, figuratively speaking, sail through it over night from an adjacent fragrant frogpond and throw up hummocks of mud on the molders' floor before morning. These "crowdads" seemed to be particularly apt sand rats, and often essayed to help the molder finish his mold. However, they held an antipathy to his company, and preferred to work alone and at night. Pit molds had a peculiar appearance after the handiwork of the dads had been put in industriously over Sunday. Upon the surface little humps of superfine mud were all that was visible, but on taking them away, a clean hole would appear, conveying the impression that the artist had gone into his hole and pulled the hole in part way after him. The molders invariably hated the dad's method of venting and would often dig away the greater part of the mold's bottom. I have often used slaked lime to keep cats from playing polo in open sand work, but there I learned to put cinders up the side of the mold to keep moles from cutting horngates and St. John's risers on the sides of large pit work. On one occasion the iron belched out through a mole hole about 12 feet away from the mold and it took nearly a car load of pig iron, which by the way was stored in the shop, to batten down the hatches. That run-out reminded me of hidden artillery, and the working of the crowdads seemed to have provided a veritable series of submarine torpedoes.

The eminent mechanic who designed the foundry and made the dumping cupola buggies so that the bottom of the buggy struck six inches above the top of the cupola door, also designed the foreman's office. It was 4 x 8 ft. and was constructed to suit the supposed vagaries of various foremen (they, no doubt, expected to have several before one stayed). It could be suspended like a bird cage from a crane and move foreman, clerk and all to any part of the shop. I suggested to a friend that it would be well to provide a special crane for the cage.

A good deal of the above sounds like a fairy tale, but if the skeptical reader had to do as I did when making a large engine bed plate, that is, bore 12-inch holes through the floor at the deep end of the mold and keep two men for nine days and nights bailing out water with a tomato can at the end of a long pole so as to keep the water from rising to within a foot of the mold's surface, he would be more liable to give credence to this seeming impossibility in a so-called American foundry.

ALUMINUM THERMIT EXHIBIT.

The National Museum at Washington have asked the Goldschmidt Thermit Co. to donate to them its entire exhibit as it was installed at the St. Louis Exposition, in order that it may be placed in the National Exhibition as a permanent exhibit. The Goldschmidt Thermit Co. have agreed to do this, and the exhibit will be sent to Washington. This exhibit has already been described in THE FOUNDRY, and it will be remembreed that it contained a great many very valuable and interesting specimens showing the work which can be done with aluminum thermit.

The Arenson & Kousek Foundry Co., of Racine, Wis., has leased the old Lippert foundry at Kenosha, Wis., and will reopen it soon.

RADIATOR PATTERN COSTS.

BY R. W. MACDOWELL.

In the matter of their patterns, radiator plants differ considerably from other foundries. In place of wooden patterns, carried from flask to flask as required, the radiator patterns are of iron mounted on stands, one pattern to eacl. floor or bed, the flasks being placed upon the stand, rammed up and carried to their proper places on the floors. Thus very few patterns of wood are required outside of the master patterns. The latter are usually purchased from some firm which makes a business of the manufacture of such goods, as comparatively few are used in the ordinary sized radiator plant, and it would hardly pay to equip such a plant for making them. This being the case, the pattern shop of a radiator plant is different from the regulation pattern shop, and is not large, being usually connected with the machine shop, as the greater part of the finishing of the iron patterns is done in the machine shop itself. These patterns are made in the shape of a half radiator section, both faces of the radiator being the same, one face being cast in the drag and the other face in the cope. A set of bosses for changing the pattern from steam to water, leg sections, and connecting bosses also go with the pattern. The stands on which the patterns rest are very simple, being merely a planed plate resting on four legs, with removable pins for securing the flask while it is being rammed up. These stands are usually considered as part of the pattern, and the cost charged up with that of the pattern itself, although gotten out on a different shop order.

A cost system, then, for a plant of this kind must provide a record of the master patterns, a reliable manner of getting the amount of material, and an accurate method of getting the amount and cost of foundry and machine shop labor, together with a complete record of the patterns themselves. Flasks, etc., are not usually regarded as belonging to the pattern account, being usually charged in along with equipment, and will not be taken into consideration here, the master patterns for them being run with the master pattern record.

It is much easier to start a system of this kind at the very beginning of the plant's op-

SHOP ORDER No. 718

Date June 29 1904

To W Williams Foreman Foundry Department

Please get out the following work, requisitioning for all material and issuing cards for all labor, under the above Order No. 718

2 3 column 38" Steam Renown style rad patterns Mark "O"7"P"

Weight of Iron Used 80 # Weight of Casting Finished 72 #

Date Begun 6/29/04 Date Finished 7/5/04 O.K. Helen

FORM 1.

A.M.

TIME CARD
MACHINE SHOP DEPT.
FORM NO. L-25 B

TIME EMPLOYED COMMENCED

Clock No. 8 Date 7/1/04

Boring	Drilling	Grinding	(Planing) ✓	Tapping	P.W.	D.W.
Chipping	Facing	Milling	Roughing	Threading		3.37
Cutting Off	Filing	Mounting	Shaping	Turning	Pieces	

Name Frank Morgan No. 289 Rate 40

Verified by	S.O.	C.O.	Amount
Harris	718		1.44

FORM 2.

REQUISITION FOR SUPPLIES No. 2107

Department Machine Date July 7. 1904

To Niles Storekeeper

Please furnish the following supplies for { Shop / Customers } Order No. 718

½ lb Beeswax

Thomas
Foreman

Use this slip only for the purpose intended, and do not requisition for material for more than one order on the one slip

FORM 3.

erations. If this is done the pattern record will grow naturally, and with little trouble in the way of clerical labor. If, however, this matter has been neglected at the start, it will be necessary to install it by taking a careful inventory of all patterns on hand, making out a card for each in the pattern record which will be described further on, after which the system may be carried out in the regular manner.

When a pattern or a set of patterns is required, an order like Form 1 is made out in the office, in as many copies as there are departments for the work to go through, including a copy for the office record. These copies, with the exception of the office copy, go to the factory clerk, who distributes them to the various departments through which the work has to pass. He also gives out the master pattern to the foundry, or in case the master patterns are under the charge of some one else, issues the order for their issue. On receiving his order the foreman of the foundry, which is the first department concerned in the manufacture of the iron pattern, puts a man to work on the job, giving him a card similar in form to Form 2, first registering up the time of commencing. He then files his order away until the job is completed. The time card will of course have to be made out to suit the timekeeping system used by the concern, but as a mechanical time recorder is the

O-38-S

Style Radiator Renova	Location		
No. Column 3	Floor 25		
Size 38"	Division A		
Kind Steam	Side B North Wing		
Master Pat. No. 39			
Drawing 6421 B	Material		80
Date Begun 6/29/04	Pro. Labor	11	35
Date Finished 7/8/04	Non-Pro.	1	35
Shop Order No 718	General		27
Marked O	Total	13	77

FORM 4. (FACE.)

Takes Place of	On new floor		
No. in set 5	Cost Pattern, Order 718	13	77
No. Made on Order 2	Cost Stand " 694	6	50
Changes	Cost Bosses " 719	1	30
	No. of Bosses " 4		✓
✓	Cost Leg pcs. "		✓
✓	Incidentals "		✓
✓	" "		✓
✓	Additions "		✓
✓	Total Cost	21	57

FORM 4. (BACK.)

only really satisfactory way of operating a cost system and all up to date foundries have devices of this kind, the illustrations are made on that plan. In the illustrations given here the machine used is the Calculograph, which is selected owing to the fact that all the work of registering and computing the time is done automatically, so much clerical labor is saved, and the chances for error are absolutely done away with. It is of the utmost importance in any cost system to be sure as to the value of the time put in on the jobs, this being by far the most important item.

As soon as the pattern is molded, the foreman inspects it and then turns his order, together with the time card, in to the office. The pattern is then cleaned and passed on to the machine shop for inspection by the foreman of the pattern department, and if it is good in every particular it is passed up for finishing. The order for this work has already preceded it, so the foreman issues a card like Form 2 to the man who is to do the planing. The work then goes on in the same way, the order with its accompanying time cards being turned in to the office as soon as the planing has been completed. The pattern then passes on to the pattern department to be finished by filing and rubbing up with emery cloth, time cards being issued in the same way for all future operations. Requisitions for supplies for any part of the work are made out on a slip like Form 3. These are made out in triplicate, one copy going to the office, one to the storekeeper, and one remaining in the possession of the person issuing it. No material is permitted to go out without a requisition.

MASTER PATTERN RECORD

Size 38 Kind Steam No. Col. 3 Style Renova

Material Wood No. Pos. 6 Pattern No. 39

Kept in Room 1 Side A Bin Shelf 14

Bought of S Pattern Co Date 11/8/03

Address Pittsburg Order 1189

Cost New $ 37 80 Weight of Castings

Freight $ 75

Total $ 38 55 Core Box Pattern No. 118

Remarks

Leg sections for end or middle

FORM 5.

When the pattern has been finished complete, and all the orders, time cards, requisitions, etc., pertaining to it are assembled, the Pattern Record, Form 4, is made up. A good way to collect all such papers especially when there are several shop orders out at the same time, is to have a drawer fitted up with guide cards in the same manner as a card index, using envelopes of good size in place of cards. The guide cards should be numbered by tens, and each envelope should bear the order number plainly marked, there being ten envelopes after each card. When any order copies or time cards come in, they are filed in the proper envelope, so that when the order has been completed all the data necessary to make up the record is collected in one place where it may be easily referred to.

The pattern record is run on 4 x 6 cards provided with tabs. On the face of the card space is provided for the style of the radiator, the size, kind, number of columns, and the master pattern number. The shop order number and the date follow. At the right hand side of the card is a guide to the location of the pattern and a recapitulation of the cost of material and labor. The reverse side of the card is devoted to a list of the parts going with the pattern, with their cost, also space for recording changes in the pattern, etc. These cards are filed in an ordinary card index drawer, with guide cards arranged by divisions and subdivisions. The two main divisions are steam and water, and these in turn are subdivided into single, double and three column sections and finally by sizes. The tabs on the cards bear the size, kind and mark of the pattern. In this way it is a very easy matter to refer to anything pertaining to any particular pattern, as each card bears a full and complete description of the pattern it represents, showing the location, cost and when made.

The pattern stands, bosses and leg sections are gotten out in the same way, a shop order being issued and time cards made for all operations, with the difference, however, that no record card is made, as these parts are considered to be part of the pattern, and are entered up on the record of the pattern to which they belong. It is sometimes necessary to change a pattern from one stand to another, in which case a notation of the change is

made in the section of the pattern record card marked "Changes."

Core pans and boxes are considered by some concerns to be patterns and are run in connection with the pattern account. In such cases a similar record to the one just described may be kept of these articles, the face of the card being practically the same. On the reverse side the list of parts would have to be changed, and space provided for the record of the disposition of the box or pan, as such articles are subject to rough handling and are frequently broken. Shop orders are of course issued for such articles, and are treated in the same way as the pattern orders. The card record is kept in practically the same way as the pattern record. If, as is frequently the case, it is found to be undesirable to keep the record of core pans, etc., in this way, they may be entered up in the inventory book in the same way as other equipment after the order has come in and the cost been figured.

The record of the master patterns is also kept on cards. This card, Form 5, provides much the same information as the pattern record, but as these master patterns are usually bought of outside concerns, and the cost known, it is not necessary to use both faces of the card. The description is given in about the same manner, as is the guide to the location, space being also provided for the name and address of the firm from whom the pattern was bought, with the date and the order number. As the number of the master patterns is not nearly as large as the number of the patterns proper, there need not be so many subdivisions to the guide cards, and this record can, if desired, be kept in the same drawer with the pattern record. A record of all other wooden patterns, such as flasks, etc., can also be run in connection with this record, using a slightly different ruling on the cards.

A system of this kind for keeping the cost of patterns is not difficult to run, and is valuable in many ways. Too many concerns allow their patterns to accumulate from year to year without keeping any other record than is shown at the annual inventory, and even in the inventory the values placed on the patterns are in nearly every case the result of mere guesswork. In the present records there is no guesswork, unless it may be that the small variation in the weight of the iron as reported on the order when it is returned to the office might be termed guesswork, and this is very trifling, as the weight of the casting is known exactly, the extra allowance being made for the gate, etc. With a record of this kind at hand the firm is in a position to figure accurately on this particular portion of their equipment when taking stock, and is also aided by the fact that this information is at the finger ends of the office force at all times.

SHRINKAGE TROUBLES AND METHODS OF "FEEDING." *

BY THOS. D. WEST.

A casting that is not sound is weakened in a way that makes it impracticable to apply any formula to ascertain its strength. The extent to which such unsoundness affects the life of the casting depends chiefly upon the location of the defects. In some cases unsoundness may not be of great importance, while in others it may be so serious as to unfit the casting for use; but discrimination in this respect must be left to experience and judgment.

Unsoundness in castings is produced by one of three things: A "blow hole," "dirt hole," or shrinkage. Rarely if ever are two of these factors combined. The unsound spot must be produced distinctly by either gas, dirt or shrinkage. However, it is possible for dirt to lodge in a section that would also shrink. I dwell on this feature because I believe it will assist in forming correct opinions as to the cause of any unsoundness to be found in castings.

Shrinkage as Distinct from Dirt or Blow Holes.

A few days before writing this paper I received a defective section of a valve casting and was asked to indicate the cause of the defect. This special valve casting had to stand several hundred pounds of hydraulic pressure test, which, when applied, caused a leakage or sweating of the casting at the pouring gate section. The parties sending this sample were at a loss to know whether the porous condition was due to shrinkage or dirt. They seemed sufficiently experienced to know it must be one or the other, and their doubt was natural since it was difficult for the eye alone to discern which it was. The first thing I did was to apply a magnifying glass. This enabled me to be very emphatic in attributing the trouble wholly to shrinkage, and I wrote them that if they would change their pouring gate to a lighter section I believed their trouble would cease. I heard no more from them.

*Read before the New England Foundrymen's Association, Boston, Mass., Oct. 12, 1904.

Examination by the glass showed the section that leaked to be of an open, stringy structure, reminding one of a lot of peas tied together with very fine thread. The open spaces were entirely free of any dirt, whereas the solid section of the casting was of a close uniform density. There was not the least sign of dirt being confined between the spaces, or open grains of the iron. Some might refer the trouble to confined gases causing "blow holes." These do not exist as an open-grained, stringy structure as in some forms of shrinkage. Any sponginess or holes due to confined gases appear in cavities surrounded with a structure denser than that adjoining the defects; and the surface of blow holes often appears as smooth and dense as the interior of a piece of blown glass. In fact, the formation

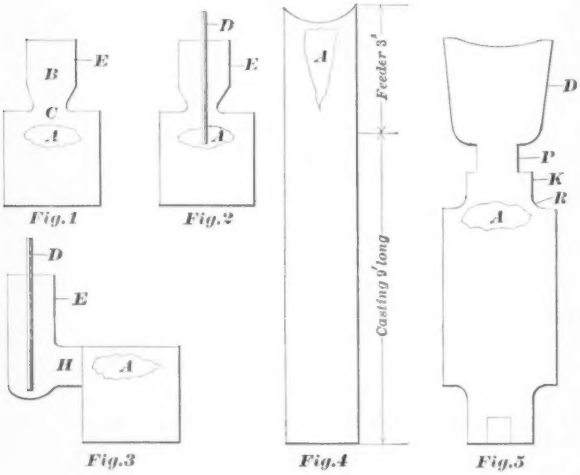


Fig.1 Fig.2 Fig.3 Fig.4 Fig.5

of holes by expansion of air or gas is upon the same principle. Molten iron or glass is easily separated by air or gas pressure, forming a void space before solidification, and molten iron will liberate gases up to a certain decrease in its temperature, just as air can escape from water before it freezes. Let one fasten the above facts in his mind and there should be no difficulty in determining whether a defect is caused by dirt, confined gases or shrinkage.

Symbols for Methods of Treating Shrinkage.

In presenting this question of shrinkage I am reminded of the excellent paper on this subject presented to you last March by Mr. Herbert E. Field. Shrinkage has been greatly discussed both in the shop and press, and it is difficult to bring out much original matter; however, I believe I have a few new thoughts the consideration of which should prove profitable.

There are several different methods for preventing shrinkage evils in castings. At present we have no terms or symbols to designate one method from another and it appears to me that to have symbols that can be universally applied would prove of service to all interested. The terms I offer to cover the present different forms of general feeding are: 1, interior rod feeding; 2, exterior rod feeding; 3, statical pressure feeding; 4, chill feeding; 5, compression feeding. The first and second terms may be used in some cases with the word rod omitted. The question of symbols is taken up at the close of this paper.

It is surprising how few molders and founders comprehend the difficulty of making a bulky casting perfectly solid through its body, and it is to be said that while skill in placing proper feeding heads and in feeding can accomplish much in avoiding the evils of shrinkage, there are forms that baffle the most skilled attempts to make perfectly solid castings.

Difficulties in Feeding and Rate of Cooling.

The great difficulty in obtaining a perfectly solid body in many forms of bulky castings is due to the exterior part solidifying before the interior, and the impracticability oftentimes of conveying to the part solidifying last, the hot metal that will fill the void space left and replenish the shrinkage. In the solidification of a casting the radiation of heat is greatest upward. The bottom and sides will solidify to a greater depth than the uppermost or top body before the whole has become solidified. As an example, a cube casting, as in Fig. 1, would have the part last to solidify at about the height seen at A. If the one feeding such a casting can maintain open communication between the hottest part A and that of the feeding head at B until A has solidified he can produce a solid casting; otherwise he will fail. What works against reaching A with occasional supplies of hot metal in such castings is the early cooling off of the top body at C. It is difficult to keep it in a liquid state to the same length of time that the metal is liquid in the more central section at A. This is generally accomplished by the use of what is termed a "feeding rod" seen at D, Fig. 2.

This is kept in motion up and down as well as sidewise. Its action keeps mixing the metal in the feeding head E, with that in the interior of the casting. This "interior rod feeding" applies to all forms of feeding where feeding heads are placed directly upon the top or cope surface of a casting.

Interior Rod Feeding.

"Interior rod feeding" secures a perfectly solid casting providing the person working the feeding rod D can keep a liquid communication between a feeding head and the interior of the casting, or that part last to solidify. To do this, as all experienced molders know, requires the greatest care and skill, and it is to be said that without these more harm than good can be done. The great difficulty with this method of feeding is in keeping the passage for fresh supplies of hot metal open until the hot spot A has solidified. The term "hot spot" was first brought out by a writer in *The Foundry* several years back. The cost of chipping off large feeding heads and the great danger of cracking some castings in doing so, cause most persons to use smaller feeding heads as a rule than should be employed. Were it possible to have feeding heads as large as the body to be fed, similar to the feeding heads for cannons, plain shafts, etc., seen at Fig. 4, there would be little difficulty in obtaining a solid interior in bulky castings.

Exterior Rod Feeding.

In taking up the exterior rod feeding, which covers all that class of work having the feeding head E set to one side of the casting and a connection cut between the two as at H, Fig. 3, a feeding rod D is generally used, the same as in Fig. 2. The main difference between the Fig. 2 and Fig. 3 plans lies in the latter never permitting the feeding rod to penetrate the casting or its "hot spot." This militates greatly against obtaining a perfect solid casting unless the feeding head E and connection H are as bulky as the casting, and even then the earlier solidification of the sides ahead of the upper center body of the casting will prevent the connection H from conveying metal to the hot spot A. However, it is to be said that exterior rod feeding, in the hands of the majority of molders, can be generally relied upon to give a more solid casting than the interior rod feeding of Fig. 3; at least there will be more of the external appearances of soundness in rough castings by the plan of Fig. 3 than by that of Fig. 2, whatever may be the internal conditions of the "hot spot." Some years back a writer in the *American Machinist* stated that he could make solid castings without feeding, or "pumping," as a few call it. He must have been deceived by external appearances, or well acquainted with the deceptive qualities of exterior feeding, and wanted others to accept external appearances to verify his claims.

Statical Pressure Feeding.

This third form includes all that class of feeding involved in the casting of cannon, shafts, rolls, etc., cast on end, where the feeding head is often made the same area as the casting or larger, extending it so that the whole may often appear like one casting without a feeding head, when taken from the mold. The principle involved is seen in Fig. 4. Here the shaft casting wanted is nine feet long, having a feeding head three feet long to make the casting solid. At A is seen the hot spot, or the body from which the metal descends to supply the shrinkage of all below it. In depending upon self-feeding, long feeding heads are necessary, and it is generally advisable to feed with a rod a few moments after adding fresh supplies of hot metal in the head, and this should be kept well covered with blacking dust, etc., to prevent the escape of heat as far as possible after every addition of new metal, and a few rod feedings.

In the case of rolls that have the neck K smaller than the body, in connection with wabblers P, it is very necessary, if employing feeding rods, to use one after every fresh supply of hot metal, in order to feed up the hot spot A; and at the latter end of the feeding the rod must be constantly used with the greatest skill, otherwise shrink holes or sponginess will be found in the neck at R, when finishing the rolls. Especially is this true of rolls having large bodies and small necks. Wabblers in roll molds are so effective in closing up the connection between the body K and head D, to prevent new metal reaching the hot spot A, that some roll founders have left them out to be machined, to form after cutting off the feeding head. Where the wabblers are omitted some depend almost entirely on self-feeding of the head, by covering it well with blacking dust after every fresh supply of hot metal. In fact this is often much safer than depending on the majority of molders to make rolls solid by working a feeding rod.

The secret of making solid rolls is to keep on reaching the hot spot with fresh supplies

of hot metal until it has solidified, and he that can best do this will be least likely to find shrink hole or sponginess at R when finishing the rolls, or the neck breaking off when they are in use. Many molders think that as long as they can keep the top and neck body of their feeding heads in a good liquid state they are doing all that is necessary; nevertheless these remarks on the advisability of reaching the hot spot with all the hot metal possible, as well as keeping the top of the feeding

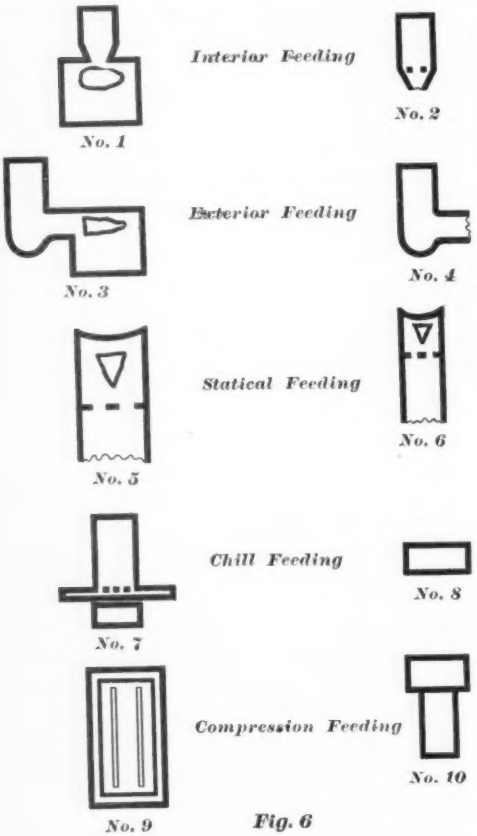


Fig. 6

head good and hot, should cause some to do a little deeper thinking.

Chill Feeding.

This method is one which seeks to prevent the formation of a hot spot and consists in forming of iron any section or part of a mold for a casting that gives trouble from shrinkage, forming in sand all other parts of the casting The chill or "chiller," as more recently termed, causes the part or parts that would be among the last to solidify, if formed of sand, to solidify in closer unison with the lighter parts that would draw metal from it, to supply their shrinkage. This is of late origin and many use the method to good advantage.

Compression Feeding.

This embodies complex proportions in thickness of castings and forms of cores, or core irons, as well as any compression methods that may be used. The expansion of the cores by reason of the rods in them, may be so great as to compress or drive the metal from heavy parts to supply the shrinkage of light, so as to decrease the body in which the "hot spot" would be created were there not a pressure to compress such heavy parts into less space. This expansion of cores or rods has been known to drive metal back out of risers and cause castings to come larger than the pattern from which they were made.

Symbols of Feeding Methods.

With the proper advance in founding it would be of advantage to have signs as well as words to designate feeding methods. In making out orders for castings, steel or rubber stamps could be used to mark on orders or chalk to mark on patterns, any methods designated in Nos. 1 to 10, Fig. 6. The foreman would thus have better assurance of molders following his desires in the choice of methods. If the foreman takes no interest in the matter but leaves it with the molder to do as he pleases, as many do, the knowledge that order blanks have provision for shrinkage symbols should cause him to recognize it as something he should study more and have better control of. The size of feeders and their position can be marked on the pattern, and if cross bars, etc., will not permit their attachment at the place designated then the molder will feel called upon to consult the foreman, instead of going ahead regardless of results, as too many do.

Drawings may also be marked in some cases with a symbol of the best method to insure sufficient solidity of the casting. If the existence of terms and symbols to designate different methods of feeding did no other good than to cause designers and draughtsmen to study the subject of shrinkage and thus make designs that would aid in securing solid castings, a good work would be done.

It is intended that the symbols opposite each other, as No. 1 and No. 2, will indicate the same method of feeding. The only differences are that one form is simpler and takes less space than the other, and that the larger symbol shows the hot spot, which might

in some cases attract more attention to the necessity of good long feeding.

Whether the terms and symbols given herein are adopted by any, this paper may be of benefit in causing recognition of the different methods that can be employed, and thus decrease the evils of shrinkage, giving us sounder castings and insuring greater use of cast iron products—a consummation which those interested should aid all they can.

FAN AND POSITIVE PRESSURE BLOWER TESTS.*

BY H. E. FIELD, MET. ENG.

At the March 7 meeting of the Pittsburg Foundrymen's Association Thos. D. West presented a paper entitled "Fan Power for the Cupola." In this paper Mr. West gave his experience in installing a fan for cupola work. He included data which showed that it required a very much greater horsepower to run the fan than had been anticipated by the makers. He called attention to the fact that the data supplied by the fan builders made no mention of the horsepower required and contended that some data should be compiled showing the power used in running a fan with an open and closed outlet. This paper brought out a very spirited discussion regarding amount of horsepower required to run a fan blower and a positive pressure blower.

A committee was appointed, as a result of this discussion, to investigate this question further. They sent out a list of questions to representative foundries, hoping that the answers would determine approximately what horsepower was being used to run a fan and a positive pressure blower. Interesting answers were received to these questions. Very few of them were complete, however, and it was impossible to obtain from them the information desired. These replies were tabulated and presented to the association at a subsequent meeting. The contradictory results reported in these answers were very unsatisfactory to the committee and Mr. W. H. McFadden, a member of the committee, volunteered to have a test made at the works of Mackintosh, Hemphill & Co. He contended that, in order to get a true comparison, tests should be made under exactly the same conditions. Inquiries were sent out to different fan and blower makers for fans and blowers to be used in the test. The Connersville Blower Co., Connersville, Ind., and the B. F. Sturtevant Co., Hyde Park, Mass., very kindly agreed to supply a positive pressure blower and a fan blower, respectively, for the test.

Construction.

The size of the cupola, together with other necessary data, was supplied to each, and the selecting of the blowers, pulleys, etc., was left to them. They were asked to have their representative present at the test, and both sent their mechanical engineer. The Westinghouse Electric & Mfg. Co. furnished a motor for the test, and supplied an engineer to take the readings. Mr. S. H. Stupakoff furnished a pyrometer and took the readings. J. & H. Phillips furnished the belts. The cupola used was 54 in. inside the lining. The piping and wind box were new and were installed by Mackintosh, Hemphill & Co. for the test. Leakage was reduced to a minimum. The positions of the blower and fan are shown in the cut on page 231. Every precaution was taken to do away with bends and elbows and whatever one was necessary it was made on as easy lines as possible. The capacity, speed of motor, sizes of pulleys, position of blowers and fans, and the arrangement of the piping were satisfactory to the representatives of the fan and blower makers.

The 33 cu. ft. positive pressure blower was placed on a solid cement foundation at a considerable expense. The No. 10 fan was placed on a heavy oak platform directly over the blower. They were so arranged in order to save room and piping and to determine one bend in the pipe for fan connecting. It was necessary to have one extra elbow in the blower connection. The pipes enter the cupola at the top of the wind box on opposite sides of the cupola. The pipe was No. 10 riveted and was guaranteed air tight by the makers. A water column pressure gauge was used for taking pressure and was attached to the wind box of the cupola.

Speed of Motor and Blowers.

The same motor was used for both tests (a 50-h. p., 220-volt, shunt-wound, rated at 825 r. p. m.). For the blower test, it was run at an average speed of 819 r. p. m. and for the fan test at a speed of 839 r. p. m. For the fan test the motor was equipped with a 30-in. pulley and the fan was fitted with a 16-in. diameter, 15-in. face pulley. The B. F. Sturtevant Co. had previously notified us that they

* Made at Ft. Pitt Foundry, Pittsburg, by W. H. McFadden, vice president and general manager Mackintosh, Hemphill & Co.

desired to run the fan at from 1,500 to 1,550 revolutions. The blower was equipped with a 60-in. pulley, 15-in. face, and the motor was fitted with a 12½-in. pulley.

First Test. No. 10 Sturtevant Fan.

The first test was made Oct. 17, 1904. The blast was supplied by the No. 10 Sturtevant fan. The fan was connected as shown in the sketch. The readings on the volt and ammeter were taken by an engineer from the Westinghouse Electric & Mfg. Co. Mr. Stupakoff took temperature readings on a Le Chatelier pyrometer.

Sixty thousand seven hundred (60,700) lb. of metal were charged into the cupola. One half scrap and one half pig was used, as being a fair representative of ordinary foundry practice. Fifteen hundred (1,500) lb. of coke were charged on bed, followed by 4,500 lb. of iron. The balance of the heat was made up of 4,000-lb. charges, with 450 lb. of coke to the charge. The last charge was 4,200 lb. of iron.

Readings were taken every ten minutes, the pressure at the cupola being taken at the same instant as were the readings at the motor. Table No. 1 gives a condensed record of this heat.

TABLE NO. 1. FIRST HEAT, OCT. 17, 1904.

No. 10 Sturtevant Fan.

Time	Pressure	No. Volts	No. Amp.	E. H. P.	H. P.	Speed	Temp.
2:02	12½	212	145	41.2	36	840	
2:10	12½	208	155	43.2	38.5	844	
2:20	12⅞	215	148	42.6	38	840	
2:30	12⅞	216	144	41.7	37	845	
2:40	13¼	216	132	38.2	33.5	850	
2:50	13½	220	128	37.7	32.5	840	
3:00	13⅛	218	130	38	33	840	
3:10	13	218	128	37.4	32.5	825	
3:20	13¼	218	120	35.1	30.5	840	
3:30	13½	220	126	37.2	32.5	845	2185° (ladle)
3:40	13¼	216	125	36.2	31.5	830	
3:50	13¾	220	115	33.9	30	845	
4:00	14	217	123	35.8	31	847	
4:10	14	217	112	32.6	28	845	
4:20	14	219	112	32.9	28.5	837	
4:30	14⅛	217	110	32.0	27.5	840	
4:40	13¾	217	105	30.5	25	833	2150° (ladle)
4:50	13¼	214	105	30.1	25	832	
5:00	13¾	214	110	31.5	26	830	
5:10	13⅞	218	110	32.1	27.5	838	
5:20	14	219	110	32.3	28	838	
5:30	14	220	115	33.9	30	840	
5:40	13¾	220	120	35.4	31	840	
5:50	13¾	219	130	38.2	33.5	837	
Avg.	13.6			35.8	31.2	839	

This shows the time readings were taken, the pressure at the cupola, the temperature of the metal, the current and voltage, readings, the electric horsepower figured from the latter and the horsepower figured from the curve furnished with the motor. The temperature of the metal was taken in order to determine whether there was any decided difference in temperature of the iron melted with the fan and blower. The material charged, including coke, was all accurately weighed. The melted iron was weighed as it came from the cupola and is recorded in Table No. 2, which gives a record of the iron melted as each ladle was taken from the cupola.

TABLE NO. 2. FAN HEAT, OCT. 17, 1904.

	Time.	Time taken.	Amount melted.
Wind on	2:02		
First tap	2:23	23 min.	
First ladle out	3:38	1 hr. 36 min.	27,630
Second ladle out	4:39	1 hr. 1 min.	14,750
Third ladle out	5:10	31 min.	6,000
Fourth ladle out (bottom drop)	5:48	38 min.	7,800
Amount taken out in shanks			700
Amount left in cupola			800
Total amount melted iron			57,680

Figuring from the above data, we find that the heat lasted 3 hr. 46 min. The average amount of iron melted per hour, based on iron melted, was 15,312 lb., or 7.65 tons. During the first part of the heat, the cupola melted at the rate of 17,200 lb. per hour. In the middle of the heat, it was melting at the rate of about 15,000 lb. per hour, while at the end of the heat it was melting but 12,200 lb. per hour. This decrease in the rate of melting was due to the fact that the tuyeres became partly closed up at the end of the heat; consequently, less wind was supplied by the fan. These data are included in Table No. 3.

TABLE NO. 3. FAN BLOWER HEAT, OCT. 17, 1904.

Total time of heat	3 hr. 46 min.	
Average amount melted per hr. based on iron charged	16,116 lb.	(8.06T)
Average amount melted per hr. based on iron melted	15,312 lb.	(7.65T)
Rate of melting, first of heat, based on iron melted	17,262 lb.	(8.63T)
Rate of melting, middle of heat, based on iron melted	15,000 lb.	(7.5 T)
Rate of melting, end of heat, based on iron melted	12,230 lb.	(6.12T)

From Table No. 1 we find that the average electric horsepower consumed would be approximately 35.8. The heat lasted 3.76 hours, so that the total e. h. p. consumed was about 134.8. The amount charged was 30.35 tons. The e. h. p. hours per ton charged would consequently be 4.41 and the k. w. hours per ton charged would be 3.29. From these data, with the cost per k. w. h. known, the exact cost of power for the heat can be figured.

TABLE NO. 4.

Total length of heat .....3 hr. 46 min. (3.78 hr.)	
Average horsepower consumed by motor.....	35.8
Total e. h. p. hours for heat.....	134.8
Number of tons charged	30.35
Number e. h. p. hours per ton charged.....	4.41
Number k. w. hours per ton charged.....	3.29
Number tons melted	28.84
Number e. h. p. hours per tons melted iron....	4.67
Number k. w. hours per ton melted iron.....	3.41

Second Test. 33 cu. ft. Connersville Blower.

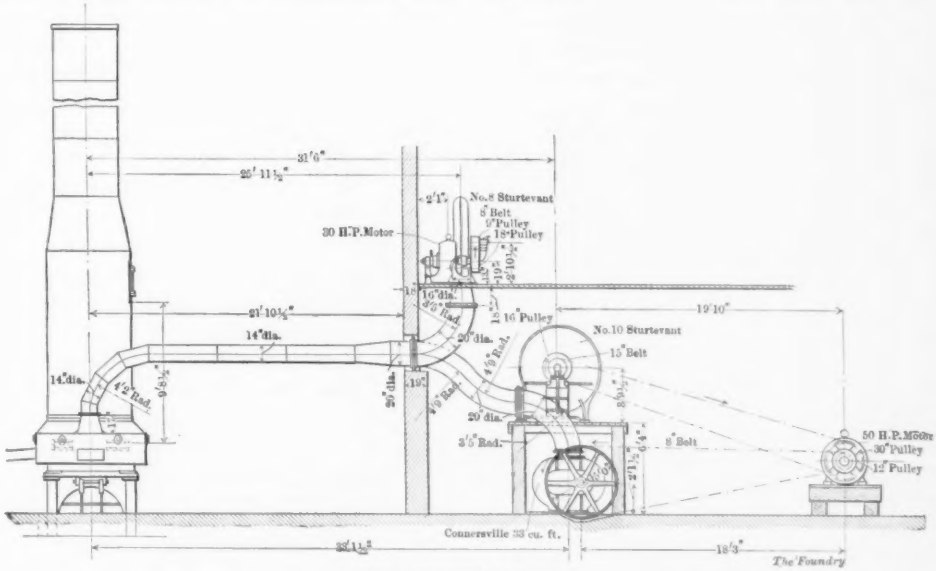
The second test made Oct. 19, 1904. A 33 cu. ft. Connersville blower was used to supply the blast. The conditions prevailing during this heat were the same as governed the test on the Sturtevant fan on the 17th. The same motor was used; the proportion of pig iron to scrap was identical; the cupola was charged in a like manner and the scrap selected was of a similar grade to that used in the previous test. The difference in piping is readily observed in the sketch. Sixty-three thousand lb. (63,000) instead of 60,700 were melted. Fifteen hundred lb. of coke were used on the bed and 4,500 lb. of iron were charged on the first charge. There were 450 lb. of coke and 4,000 lb. of iron in the next fourteen charges. On the 16th charge, 300 lb. of coke were used to 2,500 lb. of iron. This proportion of coke to iron gave a ratio of about 1 to 8, which is a fair average of foundry practice.

Table No. 5 gives a record of the time the readings were taken, current and voltage, the electric horsepower, figured from the same, and the horsepower figured from the curve sent with the motor. The speed of the motor and the pressure readings were taken at identically the same time as were the volt and ammeter readings.

TABLE NO. 5. TEST HEAT, OCT. 19, 1904.

33 cu. ft. Connersville Blower.

Time	Pressure	No. Volts	No. Amperes.	E. H. P.	H. P.	Speed.	Temp.
2:00	10½	224	80	24.0	19	825	
2:10	14¾	217	110	32.0	28	830	
2:20	14	218	108	31.4	26	830	
2:30	16½	218	118	34.5	30	835	
2:40	18½	218	130	38.0	32.5	835	
2:50	21¾	216	150	43.4	39	830	
3:00	23¼	214	152	43.6	39	810	
3:10	23	215	152	43.8	39	810	
3:20	23½	212	152	43.2	38	810	
3:30	23½	214	155	44.4	40	812	2165° (ladle) 1st
3:40	25	212	156	44.3	40	815	
3:50	24	216	160	46.3	41	815	
4:00	24	214	165	47.3	42.5	820	
4:10	25	210	177	49.8	45	815	2175° (ladle) 2d
4:20	24½	212	170	48.3	43.5	816	
4:30	20¾	214	145	41.6	36.5	830	
4:40	19¾	214	140	40.2	35	830	
4:50	19¼	215	123	35.4	30.5	780	
Avg.	20⅝			40.6	35.8	819	



ARRANGEMENT FOR TEST.

Table No. 6 gives a record of the iron as melted.

TABLE NO. 6. CONNERSVILLE BLOWER HEAT, OCT. 19, 1904.

	Time.	Time taken.	Amount melted.
Wind on	2:00		
First ladle out.....	3:33	1 hr. 33 min.	31,800
Second ladle out.....	4:05	32 min.	12,100
Third ladle out.....	4:28	23 min.	6,620
Fourth ladle out (bottom drop)	4:49	26 min.	6,950
Taken out in shanks, left in cupola, etc.....			2,207
Total amount melted iron			59,677

The total time consumed was, therefore, 2 hr. 49 min. The average melting per hour figured on the amount charged was 22,368 lb. (11.2 tons). The average per hour figured on the amount melted iron was 10.6 tons. During the first of the heat the iron was melted at a rate of 20,500 lb. per hour; during the middle of the heat, at the rate of 22,300 lb. per hour; during the last of the heat, at the rate of 17,700 lb. per hour. These data are included in Table No. 7.

TABLE NO. 7. BLOWER HEAT, OCT. 19, 1904.

Total time of heat	2 hrs. 49 min.
Average amount melted per hr. based on iron charged	22,368 lb. (11.2T)
Average amount melted per hr. based on iron melted	21,186 lb. (10.6T)
Rate of melting, first part of heat, based on iron melted	20,520 lb. (10.2T)
Rate of melting, middle of heat, based on iron melted	21,400 lb. (10.7T)
Rate of melting, last of heat, based on iron melted	17,718 lb. (8.9T)

From Table 5 we find that the e. h. p. taken by the motor was 40.0. The heat lasted 2 hr. 49 min., consequently the total e. h. p. consumed was 114.49 h. p. h. 31.5 were charged, so that the e. h. p. h. per ton charged would be 3.63 and the k. w. h. per ton charged would be 2.71. These data are included in Table 8.

TABLE NO. 8. BLOWER HEAT, OCT. 19, 1904.

Average e. h. p. supplied to motor	40.6
Total e. h. p. hours for heat	114.49
Number of tons charged	31.5
E. h. p. hours per ton charged	3.63
K. w. hours per ton charged	2.71
Number tons melted iron	29.8
E. h. p. hours per ton melted iron	3.84
K. w. hours per ton melted iron	2.86

TABLE NO. 9.

Date	Oct. 17	Oct. 19	Oct. 22	Nov. 16
Blower	No. 10 Sturtevant	33 cu. ft. Connersville	33 cu. ft. Connersville.	No. 8 Sturtevant
Tons charged	30.35	31.5	32.	31.
Tons melted	28.84	29.8	30.08	28.81
Tons iron ch'rg'd per hr.	8.06	11.2	10.9	10.07
Tons iron melted per hr.	7.65	10.6	10.2	9.40
Number of hrs. run	3.77	2.82	2.93	3.08
Av. e. h. p. (motor)	35.8	40.6	36.3	34.6
Av. h. p. (from curve)	31.2	35.8	31.55	
H. p. h. per ton chgd.	4.41	3.63	3.32	3.43
K. w. h. per ton chgd.	3.29	2.71	2.47	2.68
H. p. h. per ton melted	4.67	3.84	3.53	3.70
K. w. h. per ton melted	3.41	2.867	2.63	2.76
Av. speed of motor in r. p. m.	839	819	756	1102
Av. speed of blower in r. p. m.	1557	171	151	2204
Av. pressure in ozs.	13.6	20.6	20.75	12.5
Ratio of coke to iron.	1—7.82	1—7.78	1—7.9	1—8

In Table 9 I have included data on both tests.

Comparisons.

If we examine this table, we will note that in the two tests which we will call official, the average e. h. p. for the fan was 35.8 while the average for the blower was 40.6. The highest h. p. required by the fan was 43.2 against 48.3 for the blower. If, however, we note the total horsepower consumed, we will see that the fan consumed 134.8 h. p. h. for 30.35 tons while the blower required but 114.49 h. p. h. for 31.5 tons. This shows 4.41 h. p. h per ton of iron charged for the fan and 3.63 h. p. h. per ton of iron charged for the blower; a difference of .78 h. p. h. in favor of the blower. The difference in time of melting the two heats was 57 minutes in favor of the blower. This would allow the user of the blower to postpone putting on the blast about one hour longer for a 30-ton heat. The saving thus made would depend upon the class of work and the number of men employed. Against these advantages in favor of the blower may be set the lower original cost of the fan, the lower cost of installation, and the fact that the high pressure of the blower test was much more severe on the lining of the cupola.

The fan blower makers claim a saving in repairs and in wear over the positive pressure blower, while the makers of the latter call attention to the great wear and slipping of the belts due to the high speed at which the fan runs. These are points that cannot be settled in a two days' test.

The results of these tests show:

1. Under the conditions existing in the test, it took 4.8 less horsepower to run the fan than it did the blower.

2. That to melt a 30-ton heat it took 23.4 less h. p. h. with the blower than with the fan.

3. That it took approximately one hour longer for a 30-ton heat when the fan was used than when the positive pressure blower supplied the blast.

4. That the temperature of the metal was approximately the same for the two heats.

5. That the blower caused a much greater wear on the lining of the cupola than did the fan.

Note.—In comparing these records with other tests, it should be remembered that very heavy scrap was used and the records obtained should not be compared with a cupola melting light scrap. This difference in the weight of the scrap makes a large difference in the speed of melting in a cupola, as will be shown in the latter part of this paper.

Supplementary Tests.

In examining the data obtained from the two previous heats, I was convinced that the results obtained in the blower tests could be improved in economy by running the blower at a slower speed. To prove this, another heat was run Oct. 22. While this heat cannot be said to be official, the data should be of interest to this association. The readings were taken by our own electrical engineer Mr. Jas. F. Tracy, and all the care observed in the previous heats was observed in this one.

Third Test. Connersville Blower, Oct. 22, 1904.

In a third test, the pulley on the motor was reduced to 12 in. and the motor was run at a speed of 756 revolutions, instead of 819 revolutions, as in the previous heat. The data for this test will be found in Table No. 10.

TABLE NO. 10. TEST HEAT, OCT. 22, 1904.

33 cu. ft. Connersville Blower.

Time	Pressure	No. Volts	No. Amp.	E. H. P.	H. P.	Speed	Temp.
12:15	11	225	80	24.1	20	760	....
12:25	11¾	225	92	27.7	23.5	770	....
12:35	12½	225	76	22.9	17.5	770	....
12:45	15	225	90	27.1	23	765	....
12:55	16¾	220	100	29.5	25	765	....
1:05	19½	220	110	32.4	28	750	....
1:15	22¼	210	125	35.2	30	745	....
1:25	22¾	225	130	39.2	35	750	....
1.35	25¼	218	145	42.4	37.5	750	....
1:45	24¾	210	145	40.8	35.5	750	....
1:55	25	214	140	40.2	35	750	....
2:05	25	218	145	42.4	37.5	750	....
2:15	25½	216	150	43.4	38.5	760	....
2:25	26	210	155	43.6	38.5	760	....
2:35	26	216	155	44.9	40	770	....
2:45	26	216	155	44.9	40	760	....
2:55	21¼	220	130	38.3	34	770	....
3:05	20½	220	125	36.8	32	780	....
3:15	18¾	220	113	33.3	29	780	....
Avg.	20¾	218	124	36.3	31.55	756	....

It will be noted that average pressure was approximately the same as in the previous heat, but that the average e. h. p. was decreased from 40.6 on the 19th to 36.3 on the 22d. To be sure, the time for the heat was slightly prolonged but the total number of h. p. h. consumed was decreased from 114.49 to 106.36. The writer believes that a still further decrease in the amount of air supplied would have shown a greater economy in the e. h. p. consumed. The motor was run, however, at the slowest speed; the pulley on the motor was as small as it was possible to use and it did not appear to be practical to use a larger pulley on the blower. It would have been necessary to instal a slower speed motor to carry the investigation any further. Under the conditions, this was not practical. Further data in connection with this heat will be found in Table 11.

TABLE NO. 11. CONNERSVILLE BLOWER HEAT, OCT. 22, 1904.

Wind on 12:14		
First tap 12:38		
All melted (2 hrs. 56 min.) 3:10	59,160	
Left in cupola	990	
Total amount melted	60,150	
Rate of melting per hour (iron charged)	21,816	(10.9 tons)
Rate of melting per hour (iron melted)	20,502	(10.2 tons)
Total e. h. p. hours.....	106.36	
E. h. p. hours per ton iron charged	3.32	
K. w. hours per ton iron charged	2.47	
E. h. p. hours per ton iron melted	3.53	
K. w. hours per ton iron melted	2.63	

For a comparison of this heat with the two previous heats see Table 9.

Fourth Test.

We observed in our regular heats that better results were obtained with our old No. 8 Sturtevant fan than was shown in the test with the No. 10 fan. In order to ascertain exact figures for comparison, a further supplementary heat was run Nov. 16, using the No. 8 Sturtevant fan, arranged as shown in the sketch. This test cannot be used as a direct comparison with the others, as it was taken at a different time and the conditions necessarily varied. This fan had been used in our work for several years. The motor was a 30-h. p. Westinghouse motor and was run at an average speed of 1,100 r. p. m. Piping was new and air tight. There was one more bend in the pipe than when the No. 10 fan was tested. The readings were taken by our electrical engineer. Exactly the same conditions were observed as prevailed in the previous heats. One half pig and one half scrap was used in making up the charges. The same method of charging was observed and a ratio of 1 of coke to 8 of iron was maintained. The chief difference between this heat and the three previous was in the scrap. In the three previous heats, all the scrap used was heavy scrap in such shape as to pack closely in the cupola. In the last heat, there was a small amount of very light scrap used, which tended to keep the cupola open. The result of this will be noted in the reading found in Table 12.

TABLE NO. 12. TEST HEAT, NOV. 16. DATA NO. 8 STURTEVANT FAN.

Time	Pressure	No. Volts	No. Amp.	E. H. P.	Speed	Temp.
1:45	11	218	115	33.6	1100	....
1:55	10⅞	214	128	36.7	1100	....
2:05	11¾	220	130	38.3	1100	....
2:15	12½	220	130	38.3	1100	....
2:25	12⅞	220	126	37.2	1100	....
2:35	12⅞	220	125	38.8	1100	....
2:45	17⅜	220	125	36.8	1100	....
2:55	12⅜	218	120	35.1	1100	....
3:05	12¾	220	115	33.9	1100	....
3:15	13⅛	220	115	33.9	1120	....
3:25	12¾	220	115	33.9	1100	....
3:35	12½	220	112	33	1100	....
3:45	13¼	218	110	32.4	1100	....
3:55	13½	218	110	32.1	1120	....
4:05	13¼	218	110	32.1	1100	....
4:15	13⅛	216	110	31.5	1100	....
4:25	12½	216	115	33.3	1100	....
4:35	12¾	220	115	33.9	1100	....
4:45	11⅞	...	...	...	....	....
Average	12½			34.6	1102	

The material charged and the melted iron were weighed, as in previous heats. The temperature of the iron was not taken, but it came good and hot all through the heat. The record of this heat will be found in Table 13.

TABLE NO. 13. NO. 8 STURTEVANT FAN HEAT, NOV. 16.

Wind on	1:43		
First ladle out	2:30	12,360	
Second ladle out	3:00	10,600	
Third ladle out	3:22	7,150	
Fourth ladle out	3:47	7,720	
Fifth ladle out	4:26	11,850	
Sixth ladle out	4:48	6,790	
Taken out in shanks and left in cupola		1,160	
Total amount melted		57,630	(28.81 tons)

It will be noted from the above that the cupola melted very uniformly throughout. The average melting per hour per ton charged was 10.07 tons and the average melted iron tapped per hour was 9.41 tons. From 1.43 to 3.22, (1 hr. 39 min.), 30,110 lb. were melted, or a rate of 9.1 per hour for the first hour. In the middle of the heat, the iron was tapped at a rate of 9-½ tons per hour and, at the end of the heat, it was tapped at a rate of 9.3 tons per hour. This shows the uniform melting mentioned above. Table 14 gives the above data and Table 15 gives horsepower, etc., figured from two previous tables.

TABLE NO. 14.

Average amount melted per hr. based on iron charged	10.07	tons
Average amount melted per hr. based on iron melted	9.41	tons
Rate of melting first of heat based on iron melted	9.1	tons hr.
Rate of melting middle of heat based on iron melted	9.5	tons hr.
Rate of melting last of heat based on iron melted	9.4	tons hr.

TABLE NO. 15. NO. 8 STURTEVANT FAN HEAT, NOV. 16, 1904.

Average horsepower consumed by motor	34.6
Total e. h. p. hours for heat	106.56
H. p. hours per ton charged	3.43
K. w. hours per ton charged	2.68
H. p. hours per ton melted	3.70
K. w. hours per ton melted	2.76

This test shows a much lower e. h. p. than when the No. 10 fan was used. It will also be noted from the tables that the average pressure was somewhat lower. The e. h. p. in heat of Oct. 17th varied from 43.2 as a maximum to 30.1 as a minimum, a difference of 13.0 e. h. p. The heat on Nov. 16 varied from 38.8 to 31.5, a difference of but 7.3 e. h. p. This indicates a greater decrease in outlet in the first instance than in the second. In foundry parlance, we would say that the cupola became "bunged up" in the first instance. The rate of melting shows a decrease in the first heat, while in the latter heat the melting rate was practically constant. The reason for this is probably due to the fact that the latter heat was kept open by a mixture of some light, open scrap.

A comparison of this heat with the three previous ones will be found in Table No. 9.

Conclusions.

It is not my intention to draw any definite inferences as to the relative efficiency of the fan and the blower for cupola practice. I have endeavored rather to record the data in as complete a manner as possible. There are, however, a few points which should be brought out to make the report complete.

1. The test has proven that, under favorable conditions, a 40-h. p. motor is sufficient to supply power for a blower or fan furnishing blast for a 54-in. cupola.

2. The rate of melting is not proportional to the amount of air supplied to cupola. Too much air will tend to cool the cupola around the tuyeres and thus reduce the melting area.

3. In a 54-in. cupola, when all heavy scrap and pig was charged, the 33 cu. ft. positive pressure blower melted more economically and faster than did the No. 10 fan blower.

4. The No. 8 fan melted much more economically and faster when the cupola was kept open by a small amount of light scrap, than did the No. 10 fan when all heavy scrap was used.

5. The high pressure produced by the positive pressure blower has a much more severe cutting effect on the lining than had the lower pressure produced by the fan blower.

6. The original cost and the cost of installation of the positive pressure blower would considerably exceed that of the fan blower.

7. The actual saving in horsepower is not a large item. The saving due to the shorter time taken by the blower would depend upon the number of men employed and the price of work.

8. The difference in economy between the two types of blower depends largely upon the cupola practice. The above tests would indicate that where the tuyeres were kept clean and the cupola was not packed too tight there would not be any great difference in favor of either of the types of blowers. If the tuyeres are allowed to become partly closed, the positive type would prove the better.

Addenda.

There are two or three admitted facts that should be borne in mind in the above report.

1. In order to obtain economical results in the fan blower, all curves should be avoided as much as possible and, when necessary, should be made on easy lines.

2. A fan delivers only as much air as there is a free opening for it to pass through. The horsepower required to operate the fan decreases as the free outlet closes.

3. A positive pressure blower must supply a given amount of free air per revolution. As the opening decreases in the cupola due to closing up of the tuyeres, etc., the positive blower will force the same amount of air through this opening as it previously forced through the larger opening. It will require, however, a much larger amount of power to accomplish this.

4. The pressure of air at a cupola, as recorded on a pressure gauge, is of value for comparisons only. The number of revolutions per minute of the positive pressure blower and the amount of horsepower consumed by the fan blower are the only guides to the amount of air supplied to the cupola.

SMART WORK IN THE OLD COUNTRY.

Recently, when in Manchester, Eng., the writer saw some quick molding being done which compares favorably with anything done on machines. It was at the West Gorton works of the Great Central Railway Co., in the railway chair foundry, and the following particulars will be of interest to any advocates of machine molding, showing, as it plainly does, that for certain jobs hand labor can not be beaten. The castings in question were standard pattern chairs as used throughout the main lines of the Great Central Railway, the usual British pattern familiar to all. One man and two boys work together and by having nothing but railway chairs to produce year in to year out, the speed with which a mold is made needs to be seen to be believed. The man makes the mold while one boy rams the top part, the other boy assisting in general. The shop is arranged in beds, divided by a passage about 5 ft. wide, covered with cast iron floor plates, each bed of sand being about 2 ft. wide and long enough to hold 100 molding boxes side by side. On starting work, the whole bed of sand is turned over and tempered, then the man lays down on a molding board the bottom box, placing the pattern, which, needless to say, is perfectly made, in position. The extra boy has a box of new sand handy from which a few handfuls are taken and bedded around the pattern with the fingers. Two movements of a spade and the box is full of the previously tempered sand bed, then with the handle of his spade, the man rams around the pattern, about a dozen strokes, another spadeful is thrown on the box, the molder levels up with his feet, seizes a bar, scrapes off the surplus sand and then turns over the box. Two heavy blows on the pattern with a wood mallet, then the pattern is withdrawn and the bottom half of the mold carried to the casting bed and laid level. The whole operation, from placing the pattern on molding board to fixing finished mold on casting bed, was done in 45 seconds and the total output from the set of one man and two boys is 490 molds per day, including casting, removing castings, tempering sand, etc. Of course, the man does not touch the top part, one boy making that and placing in position for pouring. The casting is done from a ladle carried on a two-wheeled trolley which runs very easily on the iron plated passages, a similar trolley with a flat plate top being used for removing the castings. The molds are poured as soon as 200 are made, the furnace being kept going practically all day. ZELDE.

John H. Bass, the millionaire car wheel manufacturer, has sold all his stock in the Chicago Car Wheel & Foundry Co. to the Griffin Wheel Co. for $300,000. Mr. Bass founded his Chicago branch in 1873 with a capital stock of $200,000.

METALS IN FOUNDRY PRACTICE.

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Stove Works.

What are the proper dimensions of a stove plate floor? *Answer.* 8 x 35 ft.

How many flasks should a first class molder put up when the blast is put on at 3:45 P. M.? *Answer.* 28 or 30 eight inch leg bottoms.

What weight of good castings should the average floor produce after gangway losses and discount are taken out? *Answer.* A good molder will take 450 lbs. of iron sprues and gangway losses on floor work will be about 30 per cent and discount will often amount to 8 per cent.

Give me the mixture of a good breast for the cupola. We are having trouble with the tap hole wearing and as it is only a 30-in. cupola I do not like to try a brick for fear of it freezing? *Answer.* Make a breast of fireclay, rather dry so as to pound it hard.

Stop off with fireclay and one-third sharp sand.

Remark. If your molding floors are too small, stack the molds. It is very little trouble to stack two high on small floors.

Fast Melting, Lining Cut Away.

We use 72 in. cupola, 58 in. inside; 2,200 coke on bed, 200 lbs. on all charges. 4,000 lbs. iron on bed, 2,000 on all charges; 50 lbs. limestone on each charge. Pressure blown 220 RPM. 24 ft. air per rev. Blast pressure 17½ oz. Melts 13 tons per hour. Exceedingly hot fluid stove plate iron throughout heat. Draw off slag after first hour. We cannot get fire brick to stand. We never had any trouble until we used lime. Please suggest a brick that will stand.

Can a cupola lined to 54 in., blowing hard, melt faster than 58 in. with medium blast?

Answer. With such good results I should not advise any experiments except to reduce the limestone to the lowest limit, say 20 lbs. to the charge or until the slag will just run freely. You can afford to cut out bricks that burn out and insert others. If you could purchase old crucibles and grind them fine and use in your daubing it would cut less. Use just as little clay in your daubing as possible and use as much fire sand or ground fire brick as you can.

I prefer a large cupola and strong blast. 18 oz. is not excessive, but I would not advise any higher. I have run the blast up to 26 oz., but gained very little speed.

Continuous Melting.

There is no reason why a cupola cannot be run continuously. The tuyeres must be placed higher up and ample provision made for drawing off slag.

When iron beds are made about 25 lbs. of iron is drawn from the cupola and poured into iron molds to join the ends of gas pipe together.

A very small cupola with very large tuyeres, often only one, set high up and a soft blast will deliver such small quantities of hot iron every few minutes all day. The coke consumption is very great. The larger the quantity of iron melted the easier it would be to keep the cupola in good condition. "To melt 20 to 25 tons of iron per day and deliver in about equal quantities during each hour" would be practical. The ordinary round straight cupola is the best. Try raising the tuyeres 18 in. above the sand bottom and place the slag hole about 4 in. below the bottom of the tuyeres. You will have to burn enough coke to keep the iron hot.

If you are to run your cupola all through the working hours it would be best to have two cupolas and run each on alternate days.

Strength From Fracture.

A sample is sent. Wants opinion "as to whether it is strong or not. Not whether it can be drilled or how hard it is, but only as regards its tensile strength, as nearly as can be judged from fracture."

Answer. The data are insufficient. If we had the percentage of silicon or the shrinkage of a test bar of a known size we could come

a little nearer making a guess, but then it would be a guess. Strength does not vary exactly with the chemical composition, but the same iron with high silicon may make a strong small casting and a weak large casting and with low silicon may make a weak brittle small casting and a strong large casting. Either chemical analysis or a shrinkage test should be used by every founder to tell whether more or less silicon is needed.

If you measure the shrinkage of a test bar made of the same iron as a casting that is satisfactory in every way, and keep the shrinkage the same for other similar castings they are almost certain to be satisfactory. The only way, however, to know the actual strength is by actual test.

The casting submitted looks like very high silicon iron and as the casting is 2 in. diameter, I should expect it to be weak, but I have seen 3.50 per cent iron strong.

BRASS FOUNDRY NOTES.

Tobin Bronze.

Inquiry. Please inform us as to the best composition of the so-called Tobin bronze, also state any precautions which must be taken in melting or molding it. Does this bronze wear as well as phosphor bronze or manganese bronze? Which would you consider the best adapted for pinions for high speed work?

Answer. "Tobin Bronze," "Delta Metal," "Sterro-metal," and "Airch Metal" are names given to various alloys of yellow brass containing iron. Typical alloys are:

(1) Sterro-metal—Copper, 16 lbs.; zinc, 8 lbs.; tin, 8 oz.; iron, 5 oz.

(2) Delta Metal—Copper, 16 lbs.; zinc, 10 lbs.; tin, 4 oz.; iron, 8 oz.

(3) Tobin Bronze—Copper, 16 lbs.; zinc, 9 lbs.; phos. tin, 6 oz.; lead, 4 oz.; iron, 10 oz.

These alloys are supposed to possess a high tensile strength. They are strong, but not hard alloys. Were it not for the iron, they would be ordinary yellow brass. The iron is supposed to be chemically combined, not mechanically mixed with the alloy, and it is this chemical combination that is such a wonder worker in the way of tensile strength, solidity and fluidity. The best method of introducing the iron is in alloy with zinc. Ferro-zinc may, I believe, be purchased from the makers of ferro-manganese, ferro-silicon and other ferros. The quantity of iron in the zinc being known, use enough to introduce the necessary amount of iron into the alloy. The zinc added with the ferro-zinc of course displaces an equal amount of ordinary zinc.

Owing to the large amount of zinc these alloys are troublesome to cast because they will run smoky. Use the same precautions in melting and casting as for yellow brass. For the class of work mentioned I believe phosphor bronze is superior to either "Tobin" or manganese bronze, and it presents no difficulties in either molding or casting.

C. VICKERS.

Casting Silver.

Inquiry. Will you please inform me as to where I can procure books or literature treating of the casting of silver in molds made of a composition of plaster of paris and asbestos, or can you give me information as to how this can be done?

Answer. Although I have access to several large libraries, I have been unable to find any publications treating of the subject in question. The only literature I have ever seen was a short article published in the *Metal Industry* of October 1903, from which I quote as follows:

"For casting sterling silver it is now customary to use plaster of paris molds as these may be made so that the surface is as smooth as glass. Ordinary plaster of paris will not stand the heat but will crack and fly when the metal strikes it. For this reason it is customary to mix it with finely divided asbestos so as to render the mass tough.

"Fine short fibre asbestos is mixed with water and ground until the mass is about the consistency of cream.

"Plaster of paris is mixed with water in the usual manner, and a final mixture made by taking about two parts of the plaster of paris mixture, and one part of the asbestos mixture.

"After the molds have been made they are dried at a moderate heat of about 250 degrees, for some time or until the water has been driven off. The heat is then increased to about 1,000 degrees, or a red heat. This heat is retained two or three hours, and the mold is ready for use."

I gave the thing a trial and made a failure. I always meant to try again but never found time, but I learned one thing, and that was that such molds ought to be made in iron flasks, the same as if sand were used. I made my mold in a paper box, and it looked promis-

ing when set, but after exposure to a red heat, it was so delicate it crumbled to pieces.

I think that if suitable little iron flasks were used to support the mixture the result might have been different.

In place of the asbestos I suggest finely ground fire brick, as I believe it would make a stronger mold, and one equally refractory and smooth.

C. VICKERS.

Casting of Silver.

Inquiry. I should like to know how silver castings can be made?

Answer. This process depends largely upon the size of the castings to be made. If the castings are not large, they can be made in a mold made from a mixture of plaster of Paris and asbestos. Of course, the asbestos is used mainly to give the plaster of Paris vent, or in other words, to allow the gas in the mold to escape as the metal enters. If the casting is small in character, it can be made the same as gold castings are made, that is, by making an impression in cuttlebone, providing the necessary vents, and securing two pieces of cuttlebone together with wires or clamps to form a tight flask. Sometimes, where only a few silver castings are required, they are made in green sand molds, using French clay for a facing, and the molds are then baked in the oven or skin dried. Sometimes smoking the face of the mold will insure a perfect casting. J. R. P.

Casting Brass Upon Iron.

BY D. WOOD.

I have read with interest the articles relating to the casting of brass upon iron. This process has been a source of great trouble to many. I have had considerable experience in this line, including the casting of liners upon propeller shafting and also the casting of brass upon the rods of circulating pumps for marine engines. In the latter case the cast metal is only from 5-16 to ⅜ of an inch in thickness. I have tried almost every method and found that the most trouble was caused by the overheating of the shaft or rod. A practical founder will readily perceive the difficulty, for if the iron is too hot it will not allow the metal (brass) to flow in a smooth and natural manner and will cause dancing or kicking in the mold. The rod should merely have the chill taken off from it. In this case the mold will not have as great a tendency to steam as where the rod is overheated. The mold should be so gated as to allow the metal to be poured quickly.

In this work, the lower the temperature at which the metal is poured, the better, and the greater the chances for sound liners. The following will be found to be a suitable mixture for this purpose. It also possesses wearing qualities and is not liable to become spongy:

Copper, 78¾ percent; tin, 6¼ percent; zinc, 15 percent.

I hope that this will be of service to some of the other readers of *The Foundry*.

Thin Cores.

Inquiry. How can very thin cores be made with a metal support?

Answer. Thin cores have been made successfully by coating sheet iron with shellac and then sprinkling it over with graphite before the shellac was dry. H. M.

Melting Brass Chips.

Inquiry. I should like to know what flux to use in melting down brass chips in a reverberatory or air furnace?

Answer. For this work care must be exercised to see that the flame in the furnace is what is known as a reducing flame and not an oxidizing flame; in other words, that there is an excess of fuel used so that the flame is smoky. A little broken fluor spar will be all the flux that is necessary. With careful work, good clean results should be obtained, with a loss not to exceed 10 percent. This work can also be done in an oil furnace. H. M.

STEEL FOUNDRY NOTES.

Cores for Steel Castings.

Question. How are cores for steel castings made and what is their composition?

Ans. In general a core is used to make a hollow place in a casting, although forming cores, covering cores, side cores, etc., are sometimes used which form a part of the mold itself. The latter are easy enough, and may be made of the same material as the mold exactly. Interior cores have very different conditions to meet. They must be refractory so that the metal will not burn into them and so that they may be easily removed when the casting is cold. They must be collapsible, so that as the casting shrinks they will not oppose it and thereby cause it to crack, but crumble

and fall to powder. At the same time they must be strong enough to handle and indeed stand considerable handling, as they often have to be suspended by hooks or anchors. They must also give off as little gas as possible, so as not to cause blowing when poured. The ideal core would be a hollow body with rigid refractory walls of the least possible thickness.

In practice it is often impossible to realize the ideal, so we got as near it as possible by making the core as porous as possible and giving it a refractory face that has considerable strength to it but very little thickness. A splendid core is made of exactly the same material as one would use if the casting were to be poured in gray iron with the difference that it is washed with a thick coat of wash made of three parts silica flour and one part Ceylon plumbago, mixed with molasses water. It is then dried in the oven and baked, not merely dried, but baked till all the life has gone out of it and underneath the wash it is as rotten as sawdust. If the metal in contact with this core is thin—say ½ in. to ¾ in., one coat of wash is sufficient; if the metal is thicker, two or even three coats should be given with a thorough drying in between the coats. Small cores, such as one inch round cores or small flat cores, are made out of silica sand of fine grade mixed with molasses water and ground resin, in the proportion of 1 to 20. These cores are better not washed. They are very fragile before drying, but are very strong when dry. They should be thoroughly burnt. As a matter of fact, cores for steel castings can be made out of almost anything, provided they are given a sufficiently hard and refractory face and are thoroughly baked. The main trouble with most cores is that they leave too much of the drying to be done after the mold is poured. This is too late and the result is seen in blowholes, scabs and cracks.

ARTHUR SIMONSON.

ABOUT STEEL CASTINGS.

I would suggest the following answers to the gentleman inquiring about crucible steel castings:

The way to make crucible steel castings soft enough to turn freely ("easily" would be a better word) is to make the composition of the mixture right for this purpose before melting it. The softer the castings are the higher is the temperature necessary to melt the steel into a sufficiently fluid state for pouring. If the carbon is kept below 0.35 percent the machinist should not find any cause for kicking. Provided they are not absolutely too hard, so that annealing will not affect them, a great improvement is made by annealing the castings, which means they must be heated uniformly to a red heat and allowed to cool as slowly as possible.

The question, "In using machinery steel turnings, what should I use in a No. 60 crucible to make the metal flow freely so as to be sure and run my work?" is not quite clearly understood. The first answer suggesting itself is, "use plenty of *heat*." Possibly the addition of a small amount of ferro-silicon would assist. But the mixture must be "dead melted" at a sufficiently high temperature to get the results at all satisfactory. It is advisable to use some manganese, and from 0.50 to 0.75 percent may be added with advantage. Referring to the rising of metal in the sprues, I am not sure whether steel is meant in this case. The rising is generally caused by the expansion of gas within the metal, which has cooled until it is too viscous for the gas to rise completely through it; if the metal is proper in composition and has been well melted there will be no trouble of this kind. It may be overcome by taking the precaution to add a very little more manganese, or a small piece of aluminum in the ladle just before casting. Steel cannot be churned in the risers as cast iron is, for it sets too quickly.

With regard to putting clay wash in the silica sand, this is put in to give it a "bond," that is, to make it plastic so that it will be firm and strong in the mold. As little as possible should be used. A little of the mixed sand should be squeezed in the palm of the hand. If it can afterwards be held between finger and thumb without falling apart it is strong enough.

It is advisable to skin-dry the molds, but it is far better to thoroughly dry them in an oven. After the molds are poured, the question of how soon they should be dumped out depends on a variety of things. If the castings are large and thin they should be shaken out immediately to prevent the natural shrinkage cracking them. If they are heavy and solid in construction they may be safely left till cold and it will be better for the machinist. In the case of castings of unequal section, the heavy parts should be uncovered first, to enable them to cool more uniformly with the rest of the piece and so minimize the internal stresses.

The composition of the metal has a great deal to do with the case also. If the carbon is high and the casting is shaken out too soon, a blast of cold air may chill it and cause cracks, and may possibly harden it. If the steel is low carbon, there is not this danger.

Replying to the inquiry of the gentleman who wishes to know about the blast for a 2,000 lb. Tropenas converter, I am unable to give reliable figures, as I have never used (and hope I never shall) a converter of this size. A two ton converter, the size generally in use, is plenty small enough, and to attempt to use anything smaller is to invite disappointment, although there is no theoretical reason why a 2,000 lb. vessel should not work just as well as a larger one. The difficulty lies in the fact that such small quantities of iron and steel must be handled too quickly to be practically convenient, and any delays or accidents would be more than twice as serious. I think it would be impossible to make less sculls and sciaf with a 2,000 lb. converter than a 4,000 lb. one.

Steel castings can be made from metal taken from a cupola making ordinary cast iron, *if*, as the inquirer would say, the sulphur and phosphorus is not too high. But unfortunately it always *is* too high—at least the phosphorus always, and the sulphur very generally. I know of no flux which can be used in the ladle to remove sulphur and phosphorus to any appreciable extent, to say nothing of "almost entirely eliminating them." The sulphur and phosphorus in good steel castings do not exceed 0.04 percent.

ARTHUR SIMONSON.

ASSOCIATIONS AND SOCIETIES.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, Wednesday, Dec. 14, the president, B. M. Shaw, in the chair.

Announcement was made that the January meeting, which is to be the annual meeting, would be a little out of the usual. The executive committee expects to have present some men of national repute who will speak on general subjects.

The nomination of officers was taken up and President Shaw declining to serve again, the following were nominated to be balloted upon at the annual meeting:

President, John Magee, Magee Furnace Co.; vice president, W. B. Snow, B. F. Sturtevant Co.; treasurer, Geo. H. Lincoln, Geo. H. Lincoln & Co.; secretary, Fred F. Stockwell, Barbour-Stockwell Co.

For an executive committee of five the following were nominated: J. O. Henshaw, N. S. Bartlett & Co.; A. J. Miller, Whitehead Bros Co.; Harry E. Gibby, Mechanic Foundry Co.; A. N. Abbe, P. & F. Corbin; W. C. Doherty, Doherty Bros.; H. A. Carpenter, A. Carpenter Sons Foundry Co.; J. F. Lanigan, Davis Foundry Co.; S. G. H. Fitch, Vaughn Machine Co.; A. W. Whitcomb, Kabley Foundry Co.

A telegram was read from Geo. H. Hull, of New York, who was to address the association on the "Finance of Iron," stating that owing to pressure of business it was impossible for him to be present to address the meeting. As the telegram came too late for the committee to make arrangements for another speaker, President Shaw called upon some of the members to express themselves regarding the pig iron storage warrant system. As it was thought it would be to the best interests of the members of the association to learn the real status of this system, it was voted that a committee of three be appointed to investigate the matter and report to the association within three months. The chair appointed Messrs. Carpenter, Henshaw and Stockwell.

The questions scheduled for discussion at the afternoon meeting were then brought up, and in the following the gist of some of the answers is given:

Question. What have you found to be the actual saving by the use of a cinder mill?

Ans. At our plant we found that there was a good deal of loss from some source or other and we came to the conclusion we were losing about a ton a day upon the bottom. We purchased a large water mill and put it on the dump and commenced operations. We ran it all summer and besides the expense for water, etc., we made very little out of it. We could not run it during the winter time because it would freeze up. We plan now to put in a dry mill, believing it will pay us to use it and we can use it both winter and summer.

Ans. We have a dry mill installed in our plant and we are deriving great benefit from it. We figure there is an increased saving of about 5 percent per day over the old method.

Question. What have you found to be the

actual saving by the use of compressed air tools?

Ans. We have roughly estimated that with air tools one man can do the work of three with hand tools. We do not know of anything in the chipping department especially that can take its place.

Ans. In our shop we very often find it impossible to get the men to use these tools, especially the foundry lumpers. They complain a great deal when requested to use them because it has a tendency to make their arms useless, especially when they first commence to use them. In some cases this is overcome, as the men become more acquainted with the way of handling the tools and they are sometimes very willing then to use them, especially so in cases where they are on piece work. We have at times taken helpers from the machine shop and put them in the foundry and they seem to be able to handle the air tools with considerably more ease, which we think is due to their being accustomed to handling tools of a similar nature in the machine shop.

Question. What is the best fuel ratio which you have been able to obtain?

Ans. We figure as a rule a ratio of from 8½ to 8¾ to 1 and do not attempt to cut it any finer.

Ans. For cotton machinery we are melting about 36 tons per day and get a ratio of 9 to 1 and 10 to 1. We have in cases melted only 20 tons per day, but we do not think it changes conditions any as to the amount of iron you melt.

While this last question was up it was stated that the Philadelphia and Pittsburg associations made an experiment a short time ago regarding this matter. It was voted that the secretary be instructed to communicate with these associations and ascertain what results they obtained. Owing to the lateness of the hour it was voted to omit the discussion of the rest of the questions.

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry & Machine Co.

The results of tests of fans and blowers for foundry work made at the plant of Mackintosh, Hemphill & Co., were presented at the meeting of the Pittsburg Foundrymen's Association held on Monday, Dec. 5. The tests were made under the supervision of W. H. McFadden, chairman of the committee appointed by the association, and the paper detailing them was read by H. E. Field. So great was the interest in the results obtained that it was decided to devote the January meeting to a discussion of the paper. The blower and fan were loaned by the Connersville Blower Co. and the B. F. Sturtevant Co., respectively, while the Westinghouse Electric & Mfg. Co. provided the motor. S. H. Stupakoff took the high temperature measurements. The cost of installing the fan and blower was borne by Mackintosh, Hemphill & Co., and they also made all the necessary changes required in the piping. A vote of thanks was extended the concerns that aided in the tests and a committee of three was appointed to draw up resolutions of thanks to be presented to Mackintosh, Hemphill & Co. for the great interest they displayed in securing this information for the association. The results of the tests appear elsewhere in this issue.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care of J. W. Paxson Co.

The 14th annual meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club on the evening of Dec. 7, with a very good attendance. The officers nominated at the previous meeting were unanimously elected as follows: President, Thomas Devlin, of the Thomas Devlin Mfg. Co.; vice president, Alexander E. Outerbridge, Jr., of William Sellers & Co.; treasurer, Josiah Thompson, of J. Thompson & Co.; secretary, Howard Evans, of the J. W. Paxson Co.; executive committee, H. O. Evans, Thomas M. Eynon, E. E. Brown, R. C. Oliphant, Thos. B. Harkins; trustees, Thomas Devlin, Josiah Thompson, Howard Evans; official chemist, George C. Davis.

In accepting a re-election President Devlin thanked the members warmly for the honor done him, and called attention to the fact that not only was the Philadelphia Foundrymen's Association the first organization of its kind in this country, but it was also the one which had been followed in the establishment of district and national associations devoted to the trade. The association is now in a prosperous financial condition, the treasurer's report showing that it has a fund of $1,679 and no debts.

In place of the usual technical paper President Devlin introduced as the speaker of the evening, Roy U. Conger, of the Sheldon School of Scientific Salesmanship, New York, who gave an intereting address on "How to Sell Goods—at a Profit."

Mr. Conger's address was very well received, and after several members had briefly commended his views the thanks of the association, on motion of W. J. W. Moore, were voted him. Technical discussions were omitted for the evening, and the meeting was followed by a lunch at which short addresses were made by Mr. Conger, Secretary Howard Evans, and others.

New York Foundry Foremen's Association.

S. M. Williams, Dist. Vice Pres., 221 Third St., Elizabethport, N. J.

The meeting of the New York foundry foremen was held at Hotel Montgomery, Jersey City, N. J., on the night of Dec. 3.

Mr. E. Stutz, vice president of the Goldschmidt Thermit Co., gave a very interesting talk on the uses of aluminum thermit in foundry practice. He was assisted by his demonstrator, who carried on a number of experiments, such as burning a hole through a plate with the thermit steel to show its intense heat; welding up the hole again with thermit steel to show its welding properties, and making a butt weld between two pieces of pipe, to show the manner in which the heat of the reaction could be used for heating metal. He also had on exhibition a number of specimens of metal produced by the aluminum thermit process. By this process practically pure manganese free from carbon and pure chromium, free from carbon, and also many other metals which cannot be produced in the electric furnace without the presence of a large amount of carbon as an impurity. Mr. Stutz was asked a good many questions and gave answers which were of interest to foundrymen.

After the discussion on Mr. Stutz's paper a short paper was read by Mr. Thomas, which provoked considerable discussion on foundry practice. The members then adjourned to the dining room, where they partook of a very excellent dinner. At the close of the dinner, H. M. Lane, editor of *The Foundry*, who was present, was called upon and responded with a short talk upon the relationship which modern blast furnace conditions bear to the extreme variations now encountered in the composition of foundry iron.

The association then tendered a vote of thanks to Messrs. Stutz and Lane for the part which they had taken in the evening's program, after which the meeting adjourned.

Foundry Foremen's Addresses.

Mr. F. C. Everitt, secretary of the Associated Foundry Foremen, writes us stating that the mail which he has directed to several of the foundry foremen has been returned to him by the postmaster, and that he has been unable to locate them. He has sent us the following list of parties that he would like to get in touch with and if they or any of their friends can let him know of their whereabouts, it would be a great accommodation to him. Mr. Everitt's address is F. C. Everitt, care J. L. Mott Iron Works, 2413 Third avenue, New York, N. Y. Mr. Everitt says that he would like to make a strong appeal to all members of the A. F. F. to be careful to notify the secretary when changing their addresses.

John F. Hamilton, Meadville, Pa., Box 235; A. C. Hathaway, no address; J. C. Manning, 291 Maple street, Milwaukee, Wis.; L. F. Durand, no address; Louis Lund, no address; H. W. Johnson, 289 Sergeant street, Hartford, Conn.; R. J. Walker, 1488 Broadway, Cleveland, O.; W. B. Wood, 402 N. Milwaukee street, Jackson, Mich.; T. N. Burnham, formerly with Devlin Mfg. Co., Philadelphia, Pa.; G. W. Bitzenburg, formerly with Farm Tool Mfg. Co., Carrollton, Mo., and with Whitman Agricultural Co., St. Louis, Mo.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt, Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

ERIE FOUNDRY FOREMEN.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

INDIANAPOLIS FOUNDRY FOREMEN.

W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

CLEVELAND FOUNDRY FOREMEN.

W. H. Nicholls, 608 Gordon Avenue, District Vice President.

CHICAGO FOUNDRY FOREMEN.

David Spence, Dist. Vice Pres., 142 Bunker St.

MILWAUKEE FOUNDRY FOREMEN.

Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

CHARTERS OF THE LOCAL FOUNDRY FOREMEN'S ASSOCIATION.

The new charters issued to the local foundry foremen's associations by the central organization are very neatly gotten up. The charter is printed on a very fine grade of parchment paper, 12 by 15 inches, and makes a nice appearance when framed. Such a charter as this certainly should be of interest to all future members who may join any of the locals, as it shows the date of the organization of the local, the date of the organization of the central association, and the officers of the central association at the time the local was organized, which, as our associations grow older, will become extremely interesting historical facts.

The Associated Foundry Foremen
OF
NORTH AMERICA
LOCAL CHARTER
This is to Certify that the Foundry Foremen's Association of
is a Section of The Associated Foundry Foremen
of North America, and being Members by right of this Charter are entitled to all
the benefits and privileges accrued therefrom the same being controlled by the
Constitution of the National body together with all laws set forth for their guidance
In Testimony Whereof we have hereunto affixed the seal and the names of
the President and Secretary of The Associated Foundry Foremen of
North America this day of 190
President
Expires 19
Secretary

The F. Kuchenbeiser Co., San Jose, Cal., has been incorporated with a capital of $10.000, to carry on a general foundry and machine business. The directors are: F. Kuchenbeiser, August N. Kellner, Emma H. Woodrow, T. C. Barnett and V. A. Scheller.

FLUOR SPAR IN THE CUPOLA.

BY N. W. SHED.

Every few months a foundryman will get a circular or a letter from some company telling great things about a cupola flux. The flux usually has some high-sounding name like "Imperial" or "Majestic."

A letter recently received at this laboratory claimed that the flux would take out much of the sulphur and all of the phosphorus—would change all dirt, sand and iron turnings into cinder—would make cinder flow like water—would make iron softer and stronger—would make iron more fluid and smoother—would avoid cold shuts, holes and dirt—would make a clean cupola and save one to two dollars per ton on the cost of castings.

If one-half of these statements were true the flux would be most valuable, but the foundryman has little disposition to test the truth of these assertions and orders a quantity of the flux on the strength of the glowing advertisements. This flux is usually unloaded on the

foundry for three times its real value.

Foundrymen are not the only ones dazzled by these assertions, even the United States Geological Survey on the strength of such advertisements has published many of these statements as facts.

To test the truth of these claims, the Foundrymen's Laboratory of Buffalo made a trial of 1,000 lbs. of one of these fluxes, the Buffalo Foundry Co. kindly offering one of their cupolas for the test. The flux, which might be called "The Clingstone," turned out to be a common grade of fluor spar, most of it as fine as coarse sand, with a few lumps or crystals here and there. It was sold, however, on the assurance that it all would be in lump form. To answer the claim that the flux would remove sulphur, Bessemer pig iron, averaging .044 sulphur, was taken. This pig was machine cast and very clean. In order to remove the possibility of introducing unknown amounts of sulphur, no scrap was used.

The coke was sampled from several cars and found to run very even, the average sulphur being .75 percent.

The scheme followed was to run one day with the flux and use the same pig and coke with lime the following day.

The first day 8 lbs. of flux were used to 1 ton of iron, adding 20 lbs. of limestone, so that each charge of 3 tons of iron had 24 lbs. of fluor spar and 60 lbs. of limestone. The following day 120 lbs. of limestone were used and no flux.

The cupola used was a Whiting, 66 in. diameter. The castings were ingot molds, bottom poured. The sprues from each mold were drilled. The results:

Using Fluor Spar.

	Sulphur %
1st day	.094
3d day	.094
Average	.094

Using Limestone.

	Sulphur %
2d day	.100
4th day	.090
Average	.095

Loss of sulphur due to fluor spar, .001%.

This is practically nothing and shows that the fluor spar, 8 lbs. to the ton, has no effect in reducing sulphur.

On the fifth day the maximum amount of fluor spar was used, 15 lbs. to the ton. The producers of the flux caution foundrymen against using a greater quantity on account of its cutting action on the cupola lining. No limestone was used with this amount of flux. Results:

	Sulphur.
5th day	.089*
With flux	.091*
Average	.090

*Duplicate analyses.

	Sulphur.
6th day	.093*
With limestone	.091*
Average	.092

*Duplicate analyses.

Loss of sulphur due to fluor spar, .002.

This is a very small amount and might be due to a variation in the coke as much as to the influence of fluor spar.

When limestone was used with fluor spar the cinder was fairly fluid—it was necessary to pull it away with a hook occasionally.

When limestone alone was used the slag was perfectly liquid and no hook was needed.

On the fifth day when 50 lbs. of fluor spar were used, the slag was very sluggish and stringy. The cupola bottom was in bad shape the next morning, masses of iron, coke and cinder stuck to the sides of the cupola, requiring bars and sledges to break the tough cinder enclosing them.

On the sixth day when limestone alone was used, the cupola was clean, no barring or sledging being required.

The claim that phosphorus is removed is of little importance to the foundryman, for it is rarely that the founder wishes to reduce phosphorus, in fact he generally wishes to increase it. With a glassy siliceous cinder it is impossible to remove phosphorus. If the cinder should have an excess of lime, as the basic open hearth cinder has, then it is likely that fluor spar would remove phosphorus.

To practically test the claim of phosphorus removal these tests were made:

	Percent
Phosphorus in Bessemer pig used	.095
Using fluor spar—phosphorus	.110
Using limestone—phosphorus	.100

This shows that no phosphorus is removed by the fluor spar flux.

The cost of fluor spar should be considered. The lot of 1,000 lbs. cost $17; this is $34 per net ton. By car load fluor spar ought to be delivered in Buffalo for $12 per ton.

Limestone, which has an equal fluxing value to fluor spar, can be delivered for less than $2 per ton.

Foundries near the great Kentucky-Illinois deposit of fluor spar would probably find it an

advantage to mix fluor spar with limestone, for at such points fluor spar could be obtained at very nearly the same price as limestone. At this distance there seems to be no practical advantage in the use of fluor spar.

There was no indication that the iron was more fluid by using the flux. But to accurately test this and also the claim that iron is stronger will be the subject of a further investigation by the Foundrymen's Laboratory.

To sum up the results of these experiments it will be found that:

1. Fluor spar will not remove any sulphur.
2. Fluor spar mixed with limestone makes a fairly good flux in the cupola.
3. Fluor spar used alone makes a very poor flux in the cupola.
4. Fluor spar cleans the iron no better than limestone.
5. Fluor spar does not remove phosphorus.

By previous trials it has been found that limestone mixed with the coke will reduce the sulphur two or three hundredths percent, so that the statement that limestone is a better all-around flux than fluor spar is fully justified.

POINTS FOR BRASS FOUNDERS.

BY A PRACTICAL TRAVELING MAN.

We have in our country a very interesting industry and one that may assume large proportions if the right enterprise is behind it. This is the manufacture of metal letters. Almost everything has a name or a number and, while paint and printer's ink are both used extensively for these designating numbers, it is nevertheless true that metal letters and figures have been gaining and are now required in great quantities.

The people want beauty and art and are willing to pay the price. Metal letters are by far the best for two reasons. First, they are the most durable; second, when they become old-fashioned or obsolete, they still have some value as scrap metal. Aluminum, when it first made its appearance before the public, was heralded so extensively that every schoolboy began to study the new light metal. House numbers, signs, cards, many ornamental articles were and now are made from this wonderful light metal. Much of this work, of course, is stamped, but nevertheless, several foundries devote a large portion of their time to light aluminum castings of this class.

Bronze has also taken a prominent place in the same industry. An artistically designed sign of bronze letters placed upon a polished plate of rolled brass has a very pleasing appearance. Such letters are usually cast from an ordinary red metal mixture of 80 parts copper, 15 parts spelter, and 2½ parts each of tin and lead. Other letters are made from copper castings and look equally well.

The metal letters, however, that are to be the principal theme of this talk, are those used for designating or marking certain patterns. There are many designs or styles of letters, and hence any one who would engage in their manufacture would find this a sufficient line to keep him pretty busy.

Usually such letters are made from some soft white alloy, though some are made of bronze. They vary in composition, according to the different purposes for which they are to be used. A few good mixtures are the following:

Formula	Copper	Tin	Lead	Antimony	Bismuth	Phosph. Tin
No. 1.	.....	19	75	5	1	.....
No. 2.	.....	8	80	5	.....	2
No. 3.	1	35	60	.....	.....	2
No. 4.	2	48	48	.....	2	.....

Bismuth is used to make the metal run up sharp and fill all corners, but as this metal is expensive, phosphor tin is an excellent substitute and accomplishes the same results.

The most important point to be observed is that the castings must be made so that they will require very little finishing. To do this they are generally made in chills, one form of which is shown in Figs. 1 and 2. These chills can be made of cast iron, or of bronze. If of bronze, the alloy used should consist of copper and tin only. Bronze is much easier to finish than cast iron, but as already mentioned, care should be taken to see that there is no lead or zinc in the alloy, as this will cause the metal to stick fast or burn in when the letters are being poured. The letters should be cut in as shown in Fig. 1 and each letter given a separate air vent to the outside of the chill. A gate should be made large enough to give plenty of metal for shrinkage. The chills should fit together closely so as to avoid fins, and they can be provided with handles or guide pins, and in either case can be held together with some form of clamps or a vise when pouring. After the metals have been cast the finishing touches must be put on by filing or scraping the edges so as to remove any small fins and gate connections. If the

chills are cut perfectly very little work will have to be done, except the cutting off of the gates.

These letters are used for many purposes aside from the marking of ordinary standard wooden patterns. The making of name plates for machines, etc., requires a large variety of letters, and the making of name plate patterns may call for many styles.

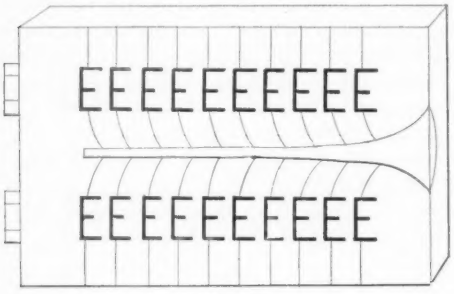


Fig. 1 Open

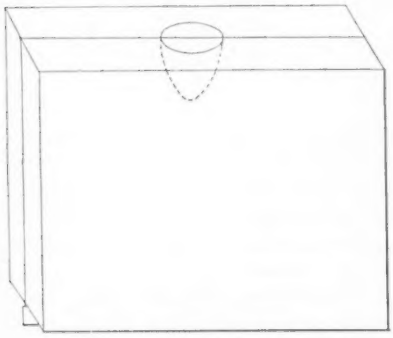


Fig. 2 Closed *The Foundry*

By using cast iron chills and making an attractive style of letters a large business could be worked up in letters and figures made of an alloy of 10 parts aluminum and 90 parts zinc. This is a beautiful white metal and can be used for house numbers, street names, hotel room doors, and in a host of other fields in addition to the uses mentioned. The larger numbers or letters can also be cast with screws or bolts attached by inserting these in suitable pockets in the chills.

PERSONALS.

Mr. A. M. Fowler, formerly identified with the Union Iron Works Co., as superintendent, at Springfield, Mo., has resigned that position to become vice president and general manager of the New Phœnix Foundry & Machine Co., which is a new industry located at Springfield, Mo. The president of the new company will be Geo. H. McCann, and the secretary and treasurer, John Schmook.

Mr. J. H. Burnett, of Fresno, Cal., was surprised recently, the occasion being his forty-eighth birthday. His wife prepared a novel surprise for him by ordering a banquet, which she had served in his foundry. His twenty-seven employees, together with a number of invited guests, were present and a table 20 feet long was arranged in the foundry and laid with all kinds of good things.

DEATHS.

Milton Wisser, foreman in the Lehigh Foundry at Fullerton, Pa., was killed by the falling of a plate in the foundry on Dec. 8.

Frederick A. Colson, who conducted a pattern works in Buffalo, died at his home in Buffalo on Dec. 1st, after an illness of only two weeks. Practically his whole life had been spent in Buffalo. He first learned the pattern-making trade and has conducted the pattern-making works mentioned for a number of years. He was a member of Company C in the 74th Regiment during the Civil War.

George Brooks, for 30 years superintendent of the foundry at the L. & N. railroad shops in Louisville, Ky., died Dec. 10 at his home in Columbus, Ind., aged 65.

Chas. H. Lawton, head of the Lawton Foundry & Machine Works, of Wabash, Ind., died at his home in Wabash on Dec. 12th. He was 62 years of age and died from tuberculosis.

Frank M. Losey, of Louisville, Ky., died on December 2nd. Mr. Losey was born in Detroit, Mich., in 1861, and for a number of years was connected with the master mechanic's department of several railroads. For some time he was in Old Mexico with the Mexican National Railway. He returned from Old Mexico and accepted a position with the Ainslie Cochran Co., which position he resigned to help found the National Foundry & Machine Co., of which he was secretary and treasurer to the time of his death. Mr. Losey was prominent in both business and social matters in Louisville.

Thomas Kimball, the first iron founder of the South, is dead at his home in Birmingham, aged 100 years. He made guns for the Confederacy during the Civil War, at which time he owned the Tannehill furnace, now the property of the Republic Iron & Steel Co.

Henry W. Warrington, one of the pioneers of Chicago, died at Los Angeles, Cal., December 1, aged 88 years. Mr. Warrington

went to Chicago in 1847 and founded the Vulcan Iron Works, which he directed for 12 years. After acquiring a competence, he retired. A few years ago he removed to Los Angeles.

FIRES.

The plant of the Michigan Heater Co., Big Rapids, Mich., was visited by fire a few days ago, and damage to the amount of $20,000 was done. The office building and assembling rooms were almost totally destroyed and the foundry was damaged.

The lock department of the Taylor & Boggis foundry, of Cleveland, O., had to be shut down recently on account of a slight fire which destroyed the belt driving the lock department.

The Friedley & Voshardt Steel Casting Plant at 194-202 Mather street, Chicago, was damaged by fire November 26 to the amount of $20,000.

The new Canadian Pacific Railway shops at Winnipeg, Manitoba, had a narrow escape from destruction by fire on the night of December 6th. There were a number of temporary buildings in which the workmen employed by the contractors were quartered, and one of these took fire. The fire spread rapidly among the temporary buildings and was communicated to the foundry building, but by the prompt and energetic action of the employees, who organized a bucket brigade, the fire was finally subdued without the destruction of the foundry.

The plant of the Home Stove Co., Chicago, Ill., was damaged by fire on December 1st to the extent of $25,000. The force of 500 men and boys was panic-stricken by the fire and rushed out with considerable excitement, but without serious injury to any.

The Connor Foundry, of Bloomsburg, Pa., was damaged by fire to the extent of $5,000 on Dec. 13. The principal loss was in the destruction of a large number of valuable patterns.

The foundry and machine shop of Alpha W. Annis, Cherry Creek, N. Y., was destroyed by fire last week. The plant will be rebuilt.

NEW CONSTRUCTION.

The American Car & Foundry Co. has broken ground at Berwick, Pa., for an addition 57 x 72 ft. to the wheel foundry, to be used for the molding of mine car wheels, increasing the output 40 wheels per day. A shed 75 x 200 ft. for the dismantling of cars for export shipment is also being put up.

The Heindel Foundry Co., Hanover, Pa., recently organized, is erecting a building 50 x 100 ft. which it expects to have completed by Jan. 1. The company will manufacture iron, brass and other metal castings.

The Geiser Mfg. Co., Waynesboro, Pa., will build a new erecting shop, 70 x 220 ft., blacksmith shop 70 x 102 ft. and two smaller buildings. At Greencastle, Pa., the company recently purchased a foundry 100 x 150 ft.

After being idle about a year on account of labor troubles, the American Steel Foundries have resumed operations at the East St. Louis, Ill., plant. Many skilled workmen were taken from the company's plant at Granite City. About 2,000 men are now employed and later 1,000 additional will be put on as a night force.

The Decatur Malleable Iron Works, Decatur, Ill., will rebuild the plant which was destroyed by fire several weeks ago. The walls of the old building will be used, but in all places where it is possible to use steel construction to make the building fireproof, that will be done.

The Fulton Foundry & Machine Works, Atlanta, Ga., manufacturer of castings and special machinery, will erect two buildings, each 120 x 300 ft., which will be equipped with modern machinery.

The Louden Machinery Co., Fairfield, Ia., has erected a fireproof warehouse and office building at St. Paul, Minn., 50 x 100 ft., two stories. This company's recently completed malleable iron plant at Fairfield is now in operation.

A 30-foot addition will be built to the foundry of the Lloyd Booth department of the United Foundry & Machine Co., of Youngstown, O.

The Day-Ward Co., Warren, O., whose foundry was recently destroyed by fire, expects to rebuild, but cannot at present give the exact dimensions. The plant will probably be of steel construction.

Edwin L. Renzenbrink will rebuild his foundry at Canton, O., which was burned some time ago.

The Bessemer Soil Pipe Co., of Bessemer, Ala., has purchased a site adjoining its plant and will at once begin the erection of a building 400 by 250 ft. which will double the present capacity of the plant.

Hanks Foundry Co., Rome, Ga., is installing machinery and increasing the capacity of its plant. It is erecting a warehouse at a cost of $6,000.

The Fort Scott Mfg. Co., of Fort Scott, Kansas, is building an addition to its foundry.

GENERAL INDUSTRIAL NOTES.

The American Graphophone Co., Bridgeport, Conn., has awarded the contract for the erection of an additional foundry, which will be a brick and steel structure, 63 x 148 ft. This is the last of the series of buildings which the company planned some time ago, and when completed will make a spacious plant.

Cooper Bros., Cortland, N. Y., have formed a company to be known as the Cooper Bros. Co., with a capital of $50,000. The directors are G. F. Cooper, Lester Cooper, and C. H. Miller, Cortland, N. Y.

The Diamond Foundry Co., Binghamton, N. Y., has been incorporated with a capital of $6,000. Incorporators are: F. Eitapene, E. I. Sherman, James Green, all of Binghamton. They will use the plant of the old Adams foundry.

The Globe Foundry Co., recently organized at Port Chester, N. Y., with a capital of $40,000, will conduct a general foundry and jobbing business. The board of directors are: John F. Mills, John M. Heatherton, of Brooklyn, Herman L. Marshall, Thomas Fitzgerald and A. Sheldon Smith, of Brooklyn. The officers are: John F. Mills, president; John M. Heatherton, vice president; Herman L. Marshall, secretary and treasurer. The company has taken a lease of the old Bent foundry and will commence operations on or about the middle of January, at which time it is expected the plant will be fully equipped with new machinery.

J. P. Luce, who has so successfully managed the Harrisburg rolling mill and tin plate works of the Lalance & Grosjean Mfg. Co. for the past four years, has resigned in order to embark in the general foundry and machine business in Harrisburg, Pa. on his own account. He has leased the foundry and machine property of W. F. Bay & Bro. and will take possession December 1. This plant, which has been idle for a long time, will be rehabilitated by Mr. Luce. The new concern will be known as the Harrisburg Iron Co.

The plant of the Lebanon Foundry Co., Lebanon, Pa., has passed into the hands of its new owner, J. R. Reise, of New York City. Negotiations have been under way for some time.

The Marion Malleable Iron Co., Marion, O., recently incorporated with a capital of $40,000, will take over the plant and property of the old Marion Malleable Iron Co. The new company will take charge as soon as satisfactory arrangements can be made with the receiver of the old company, John A. Huber. The incorporators of the new company are: Henry S. Hane, B. F. Waples, James F. Prendergast, Charles C. Fisher and Willis L. Warner.

Complete adjustment of the fire losses from the recent fire at the Day-Ward Co.'s plant at Warren, O., shows the damage to have been $7,000, and the insurance about $5,000. The company has secured a lease of the Sennett foundry at Youngstown, O., and will use this until its new foundries are completed. The Sennett plant has been closed down for some time.

The plant of the Zanesville Iron Co., of Zanesville, O., was sold at Master Commissioner's sale to A. Shoenberg, a scrap iron dealer of Newark, O., for $24,000. The company was capitalized several years ago at $200,000.

Jesse Wilson, of Baltimore, Md., has let a contract for the construction of a building 37 by 71 ft., to be used as a patternmaking plant. The building will have concrete foundations, and be constructed of brick with stone trimmings.

The Kemp Mfg. Co., of Kankakee, Ill., has been incorporated with a capital of $55,000, to carry on a general foundry and manufacturing business. The incorporators are: Jas. Kemp, M. B. Hazlett and J. H. Merrill.

A company composed of F. A. Backstrom, J. A. Babcock and Paul Bauknecht will soon be formed for the purpose of operating a foundry at Muskegon, Mich. A site for the plant has been purchased.

The Trenton Hardware Mfg. Co., successor to the Emmons-Borden Foundry & Machine Co., whose plant was destroyed by fire November 13, expects to buy or lease a plant which will be suitable for its purposes, rather than to build at this season of the year, as it is not able to build and finish a new structure as quickly as it desires. The business of the company has been rapidly increasing and it is anxious to obtain a plant as soon as possible.

The iron foundry of N. N. Hill Co., East Hampton, Conn., is to be moved about the first of January to Cromwell, Conn., and incorporated with the general foundry of the J. & E. Stevens Co. Both companies are members of the National Novelty Corporation, manufacturer of iron toys.

DO YOU USE PIG IRON IN YOUR BUSINESS?

Do you make contracts for work requiring a large amount of pig iron for a long time ahead?

Have you had experience in making contracts for pig iron containing a strike or accident clause and, in consequence of that clause, failed to get your pig iron when needed?

Would you like to make positive contracts for pig iron — contracts which would insure your getting iron at the time specified — no matter how scarce, or how high the price was, and no matter how many strikes might interfere with production?

If you would, then make contracts with your pig iron agents or dealers, for pig iron Certificates on the New York Produce Exchange to cover any contracts you make for work deliverable a long time ahead: In other words, "HEDGE;" then no matter whether iron goes up or not, you are protected, and are in no danger of having your legitimate manufacturer's profit taken away from you by the scarcity of pig iron, or an advance in its price.

Illustration:

Many years ago I watched with anxiety the career of an acquaintance who was the owner of large flour mills. I was aware that he had failed in that business at one time, and I feared a second catastrophe, for I knew he frequently made large deals in grain certificates on Exchange, and as large fluctuations in the price of grain frequently occurred, I thought one of them would catch him. He kept right on, however, apparently unconcerned about the "ups" and "downs," and apparently getting richer each year. Once I heard him say that he never speculated. This shook my confidence in his veracity, although he had the reputation of being a perfectly truthful man. Afterwards, the riddle was explained to me. Instead of being a speculator, as I supposed, he had been just the reverse; in fact, by his purchases and sales of grain certificates, he had eliminated all speculation from his business, and no matter whether the market price went up or down, he was, through the protection given him by these sales and purchases, realizing his legitimate manufacturer's profit. It seems that in his early experience in the milling business he had at one time made contracts for a large amount of flour for future delivery, relying upon the purchases of wheat he had made, many of which failed to be delivered when the great advance in price took place, and his failure was the result. A friend came to his assistance and started him in business by loaning him money and giving him advice. This advice was, that whenever he sold flour for future delivery, he should buy grain certificates on Exchange for like amounts, and when he purchased actual wheat out of which to make his flour, he should sell an equal amount of his certificates. In this way, he protected himself constantly against loss through advances in the price of wheat, and by this means had insured his regular milling profit.

The great value of Exchange dealings in iron is well illustrated in the cotton, grain and provision business. These three articles make up the great majority of the eight hundred and fifty millions of farm products exported from the United States. Most of this immense exporting business is done by contracts made at fixed figures, to be executed several months ahead. If, on the small margin of profit the exporter is able to secure, he was obliged to take the risk of such advances in price as often occur in these articles, he would often be subjected to great losses. The same instinct which prompts him to insure his property against possible loss by fire, prompts him to insure himself against possible loss on his export contracts through advances in price. This he does by making contracts on Exchange covering the same article which he has sold for export, and for a like amount. When the time for shipment arrives, he buys the article he has contracted to export, in the open market, and sells his Exchange certificates for like amount. If the article has advanced in price between the day of his contract and his purchase for shipment, he pays that much more for the article and gets that much more for his Exchange contract. If it has declined in price, he pays that much less for what he buys and gets that much less for his Exchange contract. Thus he avoids all risk from market fluctuations, thereby protecting his exporter's profit.

AMERICAN PIG IRON STORAGE WARRANT COMPANY

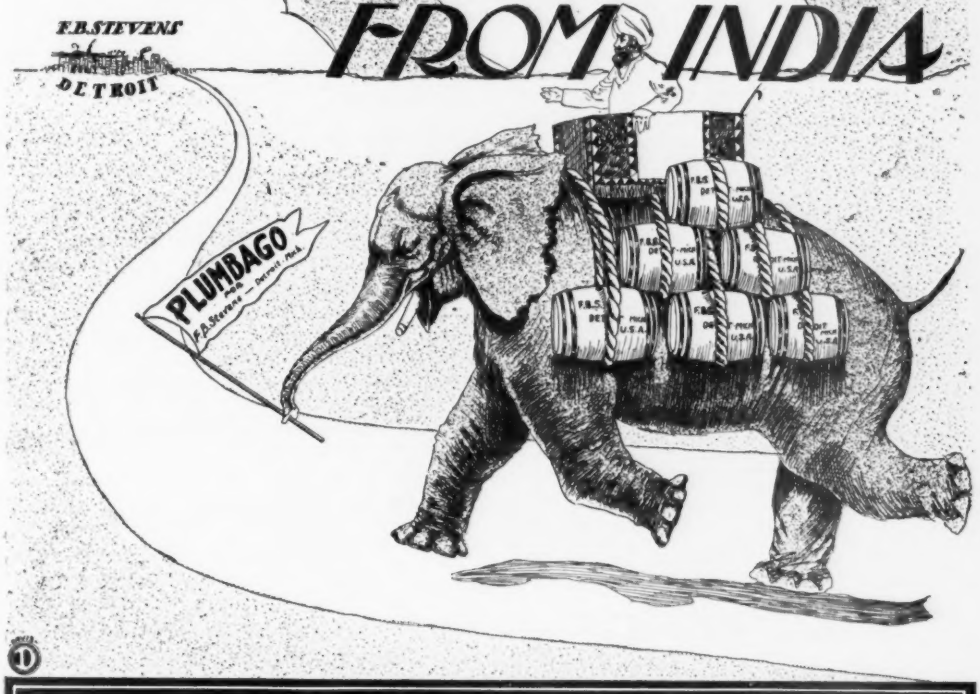
By Geo. H. Hull, President **44 Wall St., NEW YORK**

Alphabetical Index to Advertisers.

Adams Co. 12, 49
Addy, Matthew, & Co. 70
Ajax Metal Co. 54
American Air Compressor Works 67
American Blower Co. 24
American Glutrose Co. 62
American Pig Iron Storage Warrant Co. 43
Arcade Mfg. Co. 15
Asbury Graphite Mills 9
Atlas Car & Mfg. Co. 51
Balkwill Pattern Works 65
Barbour-Stockwell Co. 60
Barnard & Leas Mfg. Co. 55
Barnett, Oscar, Foundry Co. 23
Bartlett, N. S., & Co. 70
Battle Creek Interior Finish Co. 56
Blackwell, Geo. G., Sons & Co. 66
Blaisdell Machinery Co. 67
Blake, Geo. F., Mfg. Co. 48
Brass Founders' Supply Co. 61
Bristol Co. 69
Brown Specialty Machinery Co. 19
Bryan Vacuum Molding Machine Co. 63
Buffalo Foundry Supply Co. 7
Burdick & Son 64
Butler, A. G. 68
*Byram & Co. 55
Carborundum Co. 57
Case Mfg. Co. 61
Cherry Valley Iron Co. 31
Chicago Pneumatic Tool Co. 66
Church, S. R., Co. 67
Clark Cast Steel Cement Co. 59
Clark, D. N. 22
Clayton Air Compressor Works 48
Coburn Trolley Track Mfg. Co. 37
Columbus Iron & Steel Co. 70
Connersville Blower Co. ..... outside back cover
Cornell, J. B. & J. M., Co. 68
Crystal Fluor Spar Mining Co. 68
Curtis & Co. Mfg. Co. 32
Dalton, Nash & Co. 70
DeCamp Bros. & Yule Iron, Coal & Coke Co. 70
Dempwolf, E. A., & Sons 68
Delano, E. A., Co. 17
Diamond Clamp & Flask Co. 67
Dimmick, J. K., & Co. 70
Dings Electro Magnetic Separator Co. 53
Dixon, Joseph, Crucible Co. 40
Domhoff & Joyce Co. 70
Electric S. & A. Co. ..... inside back cover
Elm City Engineering Co. 62
Etting, Edward J. 63
Falls Rivet & Machine Co. 18
Fanner Mfg. Co. 57
Field, Robt., Sales Agency 71
Gautier, J. H. & Co. 38, 67
General Chemical Co. 68
Genesee Metal Works 67
Gilmour, J. 51
Gobeille Pattern Co. 65
Goodrich, F. A., & Co. 70
Gould & Eberhardt 63
Hancock Inspirator Co. 50
Hanna Engineering Works 26
Heyl & Patterson 50
Hill & Griffith Co. 5
Hillman, J. H., & Son 70
Hunt, C. W., Co. 68
Ingersoll-Sergeant Drill Co. 49
Keep, W. J. 59
Kendall & Flick 68
Kent Mfg. Co. 20
Kilbourne & Jacobs Mfg. Co. 64
Lindsay, W. W. & Co. 58
Manning, Maxwell & Moore 50
Maris Bros. 52
Maurer, Henry, & Son 68
McCormick, J. S., Co. 8
McCullough-Dalzell Crucible Co. 41
McKeefrey & Co. 71
McRath, T. S., & Co. 70
Metallurgical Laboratory 69
Middleditch, Benjamin 56
Midvale Mining & Mfg. Co. 67
Millett Core Oven Co. 29
Mills, C. E., Oil Co. 54
Mohr, J. J. 71
Monarch Engineering & Mfg. Co. 34
National Jeloluse Co. 64
New Era Mfg. Co. 66
Niles-Bement-Pond Co. 52
Northern Engineering Works 53, 58
Obermayer, S., Co. ..inside front cover and page 1, 2
Oregon Foundry & Machine Co. 16
Osborn Mfg. Co. 64
Otis Steel Co. 65
Pangborn, Thos. W., Co. 67
Partamol Co. 47
Pawling & Harnischfeger 61
Paxson, J. W., Co. 3, 4
*Pettinos Bros ..... —
Philadelphia Pneumatic Tool Co. 33
Phosphor Bronze Smelting Co. 65
Pickands, Brown & Co. 70
Pickands, Mather & Co. 71
Pilling & Crane 71
Pridmore, Henry E. 11
Rand Drill Co. 27
Republic Iron & Steel Co. 30
Ricketts & Banks 69
Ridgway, Craig, & Son Co. 28
Roessler & Hasslacher Chemical Co. 66
Rockwell Engineering Co. 35
Rogers, Brown & Co. 71, 72
Roots, P. H. & F. M., Co. ..... Colored inset
Sellers, Wm., & Co. 36
Shepard, Chas. G. 71
Shuster, F. B., Co. 60
Smith, J. D., Foundry Supply Co. 6
Smooth-On Mfg. Co. 21
Souther, Henry, Engineering Co. 69
Sterling Oil Co. 67
Stevens, F. B. 45, 71
Stow Mfg. Co. 63
Sturtevant, B. F., Co. 25
Superior Charcoal Iron Co. 71
Sutch & Potter 62
Tabor Mfg. Co. 13
Taylor, Robert J., Inc. 39
Taylor, Wilson & Co. 14
Thomas Furnace Co. 71
Tilghman-Brooksbank Sand Blast Co. 62
Vulcan Facing Co. 10
Walter-Wallingford & Co. 71
Whiting Foundry Equipment Co. 42
Yale & Towne Mfg. Co. 61

PLUMBAGO!

(The Genuine) DIRECT FROM INDIA



THE MINES OF CEYLON, East India, yield the best Plumbago in the world,— that is why I take the trouble to import it a distance of 12,120 miles. It is so superior that it is worth the trouble.

Genuine East India Plumbago gives to castings a handsome, smooth finish impossible to obtain in any other way. It also saves much time in cleaning and as a less quantity is needed, the reduction in cost is worth careful consideration.

One cask will convince you, as it has already convinced many others. I have letters enough to this effect to fill an ordinary cupola.

I will send a sample cask on approval; if not found to be satisfactory, it may be returned and I will stand freight both ways.

It is up to you to be convinced at my risk.

I am a specialist — you can buy everything for a foundry at my shop, but it will be the best there is. That is my specialty.

FREDERIC B. STEVENS
Detroit, Mich.

Undisplayed Advertisements.

Rate thirty cents per line each insertion. Answers addressed to our care will be forwarded.

FACINGS.—THE BERG MINING CO. always sells uniform grades; prices always lowest.

FOR SALE.—Cupola, 38-inch, rattlers and blower, for small foundry. THE J. H. DAY CO., CINCINNATI, O.

WANTED.—Second-hand pulley molding machine, with patterns; for pulleys, up to 36 inches. Box L., Station B, CINCINNATI, OHIO.

WANTED.—Foundry Foreman with experience on heater work. Address, stating experience and reference, L. B., Box 178, GENEVA, N. Y.

WANTED.—Five power molding machines, especially adapted to pipe fittings of various sizes. Manufacturers please address Box 565, OIL CITY, PA.

WANTED.—First class brass molder for floor work; state wages wanted and give reference. Address Box 371, THE FOUNDRY, CLEVELAND, OHIO.

WANTED.—Cupola Man who understands melting brass in cupola; state experience, wages and references. Address Box 372, THE FOUNDRY, CLEVELAND, OHIO.

BERG MINING CO., 123 Front St., New York. Prices lowest, goods best, qualities uniform.

FOREMAN with six years' experience in charge of core department desires position. Specialty, malleable and grey iron. Best references. Address Box 367, THE FOUNDRY, CLEVELAND, O.

WANTED.—A strictly temperate molder, 25 to 35 years old, experienced in green sand and loam work, as an assistant foreman. Address Box 374, care THE FOUNDRY, CLEVELAND, OHIO.

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address GEO. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or agents Penna. Salt Mfg. Co., Pittsburg, Pa.

POSITION WANTED.—By a foundry foreman or manager who would like to make a change. A practical molder, with a technical education. A1 chemist and metallurgist. Address, Box 378, care THE FOUNDRY, CLEVELAND, O.

WANTED.—Partner understanding the foundry business, to put in a foundry in connection with machine shop now running. Strictly business. Address SOUTH GEORGIA MACHINE SHOPS, VALDOSTA, GA.

WANTED.—First class job bench molders and machine molders. Standard wages for good men. Good climate and low living expenses. References required. Apply to AMERICAN CASTING CO., BIRMINGHAM, ALA.

BLACKLEAD, German. The best on earth, lowest prices. BERG MINING CO., NEW YORK.

WANTED.—First class brass foundry foreman who has had experience on large brass and bronze machinery castings. State wages wanted and give reference. Address Box 370, THE FOUNDRY, CLEVELAND, OHIO.

FLUOR SPAR.—We furnish best grades on the market. Ground lump or gravel. No order too small for our attention nor too large for our capacity. Prices on request. KENTUCKY FLUOR SPAR CO., MARION, KY.

FOREMAN BRASS MOLDER WANTED.—Thoroughly experienced brass molder, capable of commanding labor. Philadelphia foundry, running on general line of railroad work. Box 376, care THE FOUNDRY, CLEVELAND, OHIO.

FOR RENT.—Large iron foundry on the Chicago, Milwaukee & St. Paul R. R. and Chicago & Northwestern R. R. on the South Side. Same can be used as storage building. Apply at HOFFMANN & BILLINGS MFG. CO., MILWAUKEE, WIS.

SILVER LEAD, East Indian and Ceylon. Best quality, lowest prices. BERG MINING CO., NEW YORK.

AN A1 foundry foreman is open for engagement January 1st., in valve fittings, pipe machinery, engine work, gray iron, ferro steel and molding machines. The best of reference. Address Box 369, THE FOUNDRY, CLEVELAND, OHIO.

BLOWER BARGAINS.

Roots Second-hand Blowers, bought, sold or exchanged for new ones. Address,
H. M. PAPWORTH,
120-122 Liberty street, New York City.

POSITION WANTED. By Foundry Foreman thoroughly competent to handle all classes of heavy and light work, mixing and melting iron in cupola or air furnace, and handling men to every advantage. Address "K," Box 368, THE FOUNDRY, CLEVELAND, OHIO.

WANTED.—Foundry Supply Salesman—young man, must be a hustler. A good salary paid to the right man. State age, salary expected, references. None but up-to-date hustlers and energetic fellows need apply. Address "SUPPLY," care THE FOUNDRY, CLEVELAND, O.

GRAPHITE, German and Ceylon. Standards of comparison, lowest prices. BERG MINING CO., NEW YORK.

WANTED.—A foundry foreman capable of taking full charge of foundry handling heavy machine castings. One who is willing to buy an interest preferred. Established business and a good chance for the right man. Address "FOUNDRY" P. O. BOX 816, ST. LOUIS, MO.

WANTED.—Position as superintendent in malleable iron business. Have had twenty-five years' experience in all kind of malleable iron from light to heavy work. Can handle men successfully up-to-date and can give the best of references. Box No. 377, THE FOUNDRY, CLEVELAND, OHIO.

WANTED.—Position as foundry foreman or superintendent, by an A1 all around molder, cupola man and iron mixer; 26 years' experience in foundry, 11 years as foreman. Age 40 with family. Can furnish gilt edged reference. Address Box 375, care THE FOUNDRY, CLEVELAND, OHIO.

PLUMBAGO, German, East Indian, Ceylon. Highest grades, lowest prices. BERG MINING CO., NEW YORK.

WANTED.—An up-to-date foundry foreman with good executive ability, solicits correspondence with a view to changing; experienced in mixing of metals, and a thorough practical molder on green, dry sand and loam work. Best of references. Address Box 373, THE FOUNDRY, CLEVELAND, OHIO.

A German 45 years of age, practical up-to-date molder for all classes of heavy and light castings, loam work, dry and green sand; also perfect in core work and a good mixer of iron—a hustler, who understands handling men, wants to correspond with firms in need of a practical foundry foreman. Best of references. Open shops preferred. Address, Box 366, THE FOUNDRY, CLEVELAND, OHIO.

Partamol

OTHERS USE IT WHY NOT YOU

THE PERFECT PROFIT-PRODUCING Parting Compound

Saves over $\frac{2}{3}$ the cost of the most expensive parting compound

And NO MATTER what price you pay for other PARTING COMPOUNDS

Partamol will save you money after a casting is made — in cutting and trimming.

Acts as a perfect separator.

Allows of easy and perfect "slicking" of the mold.

Prevents the sand sticking to the pattern, thus producing a sharp, clean, perfect mold.

Turns out a true and perfect mold with every line, shape and conformation truly delineated as in the pattern.

The following are only two of hundreds of letters that come to us daily:

AUGUSTA, GA., Dec. 7, 1904

The Partamol Co.,
New York, N. Y.

Dear Sirs:

Replying to your favor of the 5th inst., beg to say that the Partamol received from you has been tested by us and we are very much pleased with the results. It has proved very satisfactory to us.

Yours truly,
GEORGIA IRON WORKS.
J. A. Hauser, Mgr.

KENOSHA, WIS., Nov. 14, 04

The Partamol Co.
New York

Gentlemen,— We have your favor of the 11th inst., and will say in reply that we have enough Partamol on hand to last us for some little time, but we are very much pleased with the material, and will continue to use it. We appreciate your position in the matter, and will endeavor to anticipate our wants sufficiently so that there will be no delay in filling the orders.

Yours truly,
W.J.F.-C.
THE FROST MFG CO
By W. J. Frost, Sec. and Treas.

***Partamol** is packed in 25 and 50 lb. boxes, 100-200-300 lb. barrels. Ask your nearest jobber or write for booklet and free sample, or send for 10 lb. sample box for large testing purposes. Results will astonish you. Price will please you. Discounts for quantities.*

THE PARTAMOL COMPANY, 126 Maiden Lane NEW YORK

CLAYTON AIR COMPRESSOR

AIR VALVES

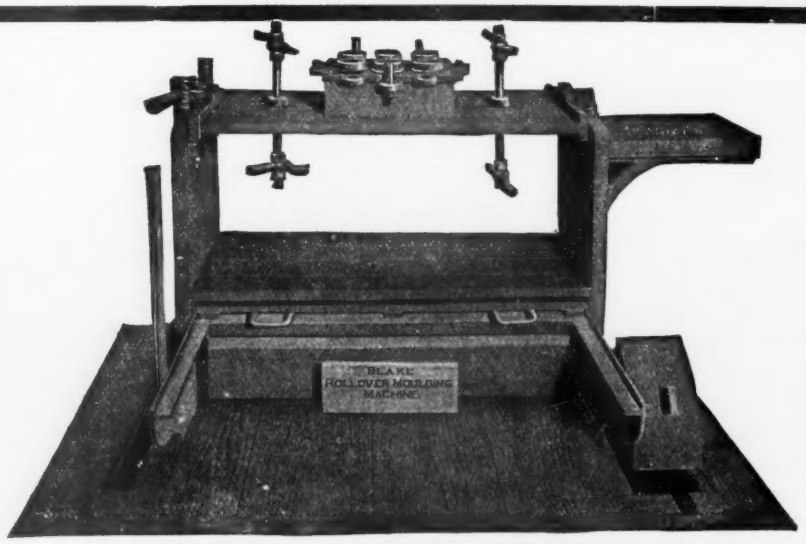
ARE SELF-CONTAINED

The valve and seat together can be taken out or replaced as one piece.
They are held in by a set-screw, and can't work loose.
Neither can they break off and fall into the cylinder.
The spindle of the valve is hollow to reduce weight, and is placed radially to the cylinder to reduce clearance, both measures increasing the efficiency.

Full particulars are given in our pamphlet C201F. Send for it.

Clayton Air Compressor Works, 114 Liberty St. NEW YORK CITY

149

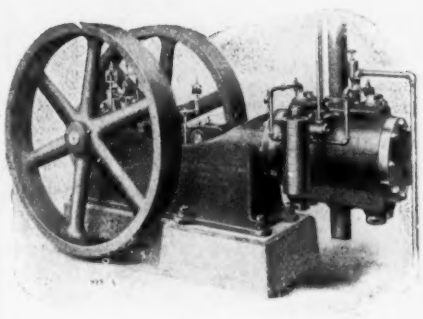


Buy a BLAKE Roll-Over Molding Machine

You can use your ordinary patterns on this machine: ordinary flasks or snap flasks. The machine is simple, and easily adjusted, and particularly adapted for small work. Find out what work you have got, and write us, and we will furnish you a molding machine at a low cost that will turn your plant into a "money maker." The accompanying cut shows the Blake Roll-Over Molding Machine, complete with levers and balancing work. In operation in our own foundry, this machine produces castings with less loss than either a full pneumatic or automatic or stripping plate machine.

The GEO. F. BLAKE MFG. CO., 114-118 Liberty St., NEW YORK 43

FOR THE SMALL FOUNDRY



Class "E" Air Compressor.

ROCK DRILLS POHLE AIR LIFT

A Power Driven Air Compressor

to operate Pneumatic tools. This type meets the conditions. It possesses *perfect automatic control.*

Several sizes ready for immediate shipment. We can supply a complete line of Pneumatic Tools.

THE **INGERSOLL-SERGEANT** DRILL CO.

CHICAGO, ILL.
CLEVELAND, O.
ST. LOUIS, MO.

26 CORTLANDT ST.
NEW YORK

H7

PITTSBURG, PA.
PHILADELPHIA, PA.
BOSTON, MASS.

The Adams Snap Flask

Selected Dry Cherry

1 1-16 inches thick, is used in our flasks which alone costs more than all of the material used in the ordinary flask.

Corners

of the flask are machine locked, giving greater surface for gluing and a stronger joint than is possible to obtain from a dovetail or mitre.

Trimmings

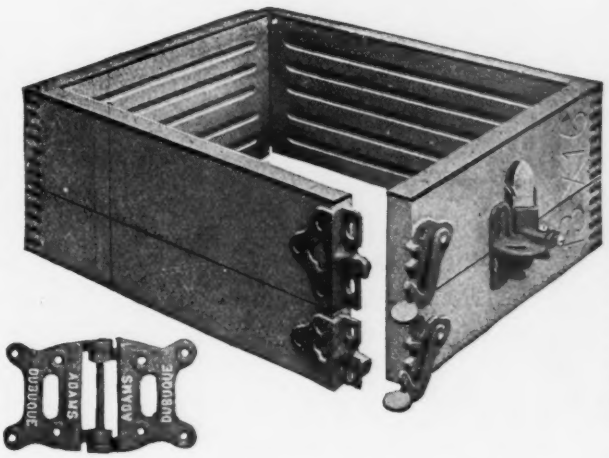
are of malleable iron. The snaps are without doubt the quickest snaps to operate.

Top Irons

which protect the edges of both cope and drag are ½ x 1 inch wrought iron with WELDED CORNERS, which make the flask more rigid.

Pins and Ears

of malleable iron, with ¾ inch milled bearings on each side of the right angle. Fine adjustment in both ears is provided by means of a screw on the ends of the ears. Both ears being adjustable, cope and drag are easily kept in line.



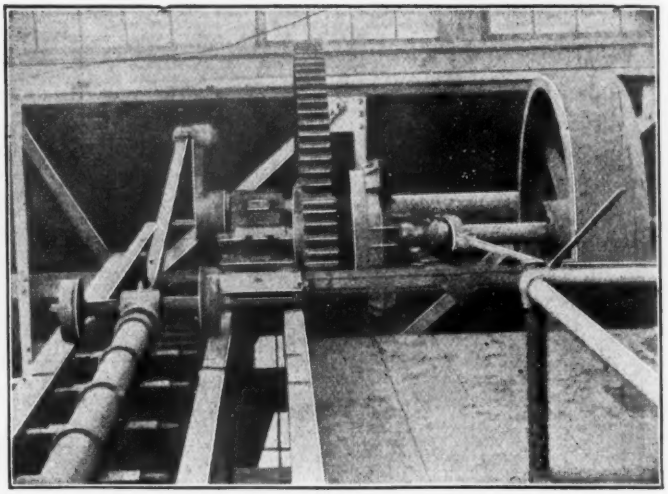
THE ADAMS COMPANY

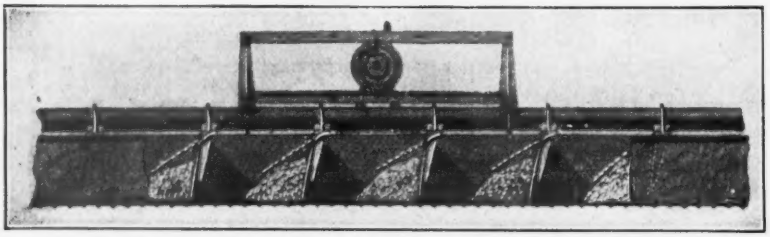
Dubuque, Iowa, U. S. A.

Heyl & Patterson,

ENGINEERS AND CONTRACTORS,
PITTSBURG, PA.

ELEVATING AND CONVEYING MACHINERY
RECIPROCATING CONVEYORS FOR TRANSPORTING SAND.
FEEDING AND MEASURING DEVICES FOR THE AUTOMATIC TEMPERING OF SAND.
SLOW SPEED, PERFECT DISCHARGE ELEVATORS.

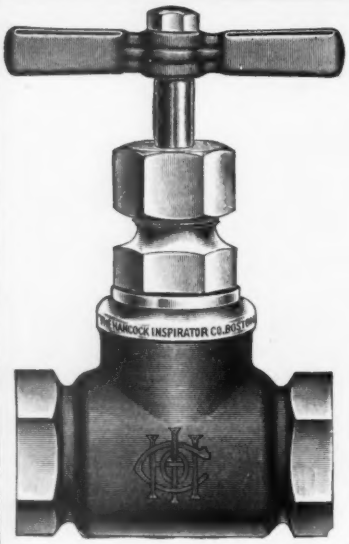




Views of 230-foot Reciprocating Sand Conveyor at Westinghouse Air Brake Co's Foundry, Wilmerding, Pa.

PATENTS PENDING.

Complete Installations.



THE HANCOCK VALVES

MADE IN ONE GRADE ONLY

Our Guarantee

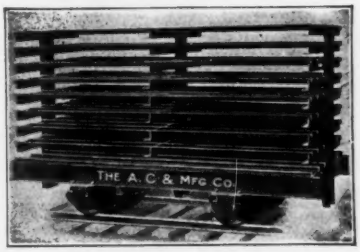
"We guarantee that each and every Globe, Angle, 60° and Cross Valve, with our monogram on it, has been tested with 1,000 lbs. water pressure and found tight before leaving our works."

Write at once for our New Valve Book

THE HANCOCK INSPIRATOR COMPANY

85-87-89 Liberty Street
NEW YORK CITY

22-24-26 So. Canal St.
CHICAGO, ILL.



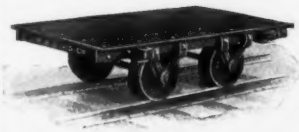
No. 231 A.—Core Oven Car.

No. 600.—Steel Dumping Bucket.

The Atlas Car & Mfg. Co.

CLEVELAND, OHIO.

Manufacturers of



No. 287.
General Purpose Car. Made in sizes to order.

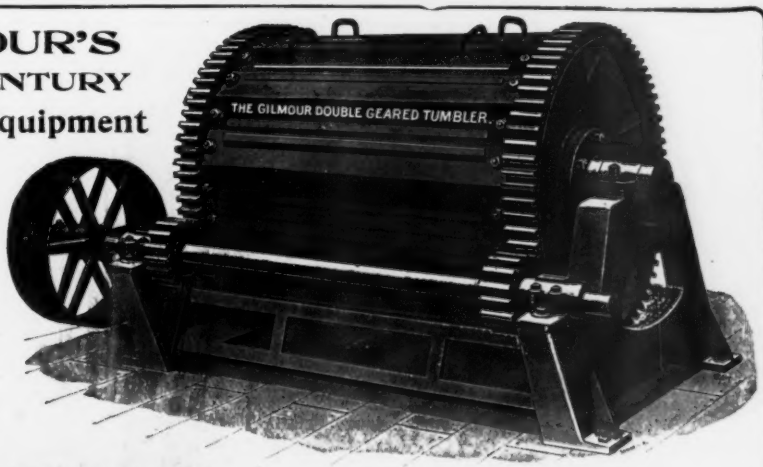
Small Cars of all kinds for various purposes, Sand Buckets, Turntables, Rails, Frogs, Switches, Etc.

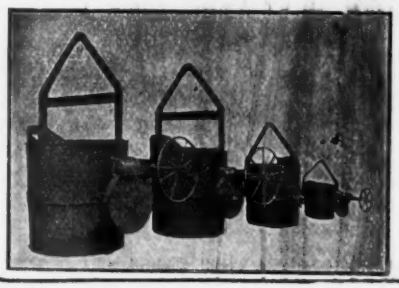
Foundry Equipment a Specialty.

No. 145.
Ball Bearing Turntable. Made in sizes from 4 ft. to 11 ft. in diameter.

GILMOUR'S 20th CENTURY Foundry Equipment

CUPOLAS
TUMBLERS
TRUCKS
CRANES
LADLES





Gilmour's Double Spur-Geared Tumbler

is the longest-lived and most practical mill ever put on the market. Let us tell you more about it.

J. GILMOUR

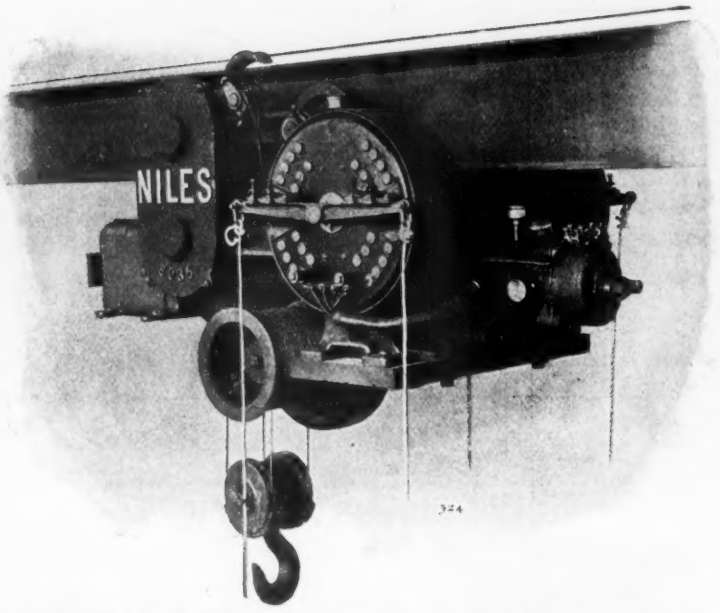
Bennett Building **New York City**

NILES

ELECTRIC TRAVELING

CRANES AND HOISTS

Equipped with any standard make of motors

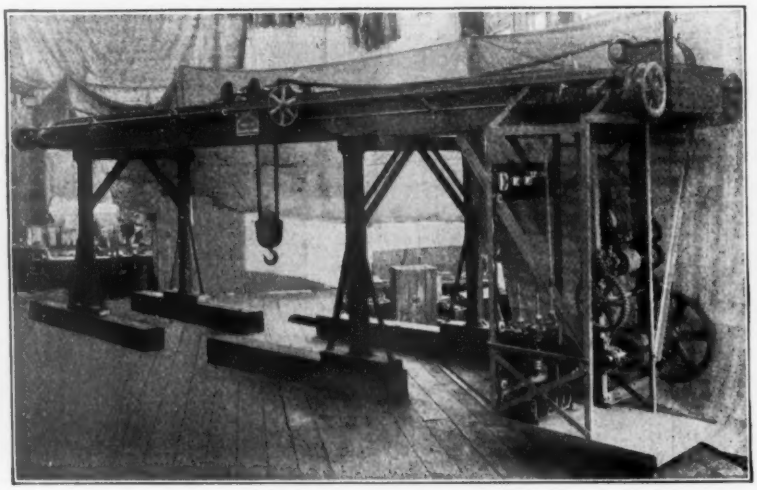


NILES-BEMENT-POND CO.

136-138 Liberty St., New York, U.S.A.

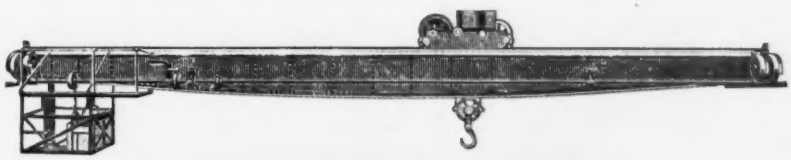
Chicago Boston Philadelphia Pittsburg St. Louis London

FOUNDRY CRANE



Where the head room is limited and the ladle of hot metal comes close up to the bridge, it is desirable to keep the hoist and motor away from the heat. In addition to the usual automatic electric and mechanical brakes the hoist is provided with a hand brake which gives absolute control of the lifting speed from full speed with a full load, to a few inches a minute for drawing patterns.

MARIS BROS., Philadelphia, Pa.



NORTHERN CRANES

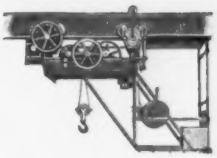
"Are Good Cranes"

Electric . Hand . Pneumatic

1 to 100 Tons Capacity

Traveling or Jib or Locomotive
Electric and Pneumatic Hoists

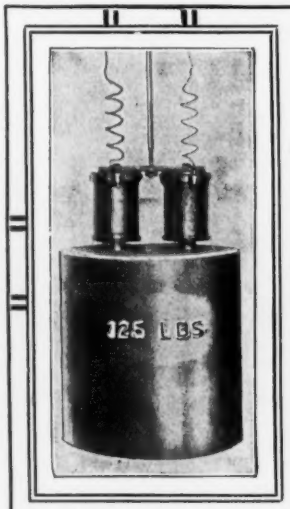
Over 100 Designs



Write for Prices and Catalogue

NORTHERN ENGINEERING WORKS

4 CHENE STREET: DETROIT, MICH.



An Attractive Proposition

We will ship on approval, to any reliable foundry having good commercial rating and melting five tons or more of iron per day, one of our money-making iron-saving magnetic separators.

A prominent official of the American Foundrymen's Association, recognized as one of the best posted men in the United States on foundry matters, has said, "The Electro-Magnetic Separator is a money maker in any foundry. In all cases coming under my observation, they have paid for themselves in three months."

In buying a separator it pays to get the best. If you do not already know that the

Dings Electro-Magnetic Separators

lead all others in points of excellency, write to us and learn the truth.

We have been building Magnetic Separators for a long time. It is our exclusive business. Perfection in this one particular kind of machinery has been our aim, and everybody knows that we have hit the mark.

We build Separators for Iron Foundries, Brass Foundries, or for any special requirements. If you are interested write to us.

DINGS ELECTRO-MAGNETIC SEPARATOR CO.

Milwaukee, Wis.

C. E. MILLS, Specialist

SYRACUSE DRY CORE COMPOUND

leads everything for heavy cores. No blow or absorption of moisture.

SYRACUSE LADELENE COMPOUND

Facing, Core Wash, Lining for Ladles, Cupolas, Locomotive and Stationary Fire Boxes, Gas Works, etc.

SYRACUSE XX CORE OIL

Perfect adaption for all work. Best Core Oil on the market.

References given to the largest foundries in the country

C. E. MILLS OIL CO. Sole Manufacturers **Syracuse, N. Y.**

FOUNDRYMEN

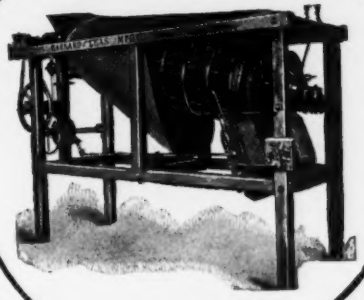
TAKE NOTICE

WHY use phosphor bronze and similar metals for bearings when plastic bronze costs no more and has decidedly better anti-frictional and wearing qualities? Your customers will stay with you, if you make their bearing castings of this metal.

THE AJAX METAL COMPANY

Main Office and Works, Philadelphia, Pa.
Branch Plant, Birmingham, Ala.

SAVE YOUR IRON



THE MAGNETIC SEPARATOR

will separate and save the iron from your foundry refuse, cupola drop and slag.

It will save what was formerly a total loss. You will, therefore, increase your profits by as much as the machine saves.

Does not this commend itself to you as a good business proposition?

Full information is given in our Circular M. M.

Barnard & Leas Mfg. Co.

Moline, Ill., U. S. A.

NONE SO GOOD AS

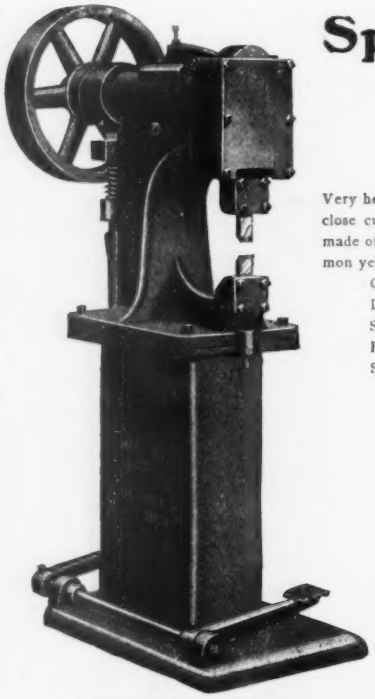
Manufactured only by

BYRAM & COMPANY

Incorporated

DETROIT, MICH., U. S. A.

Foundry Machinery



POWER SPRUE CUTTER

Sprue Cutters

that cut a good slice off your Foundry Cost

Very heavy, has large wearing surfaces, cutters will remain in line and make clean, close cuts. It is fitted with a very simple clutch, the wearing parts of which are made of tool steel. The machine will cut a piece equivalent to ¾ in. square common yellow brass and is guaranteed in every particular.

Cutters are made of best tool steel 1½ x 5-8 in.	
Depth of throat from cutting edge	10 in.
Space up and down back of cutters	12½ in.
Height over all	5 ft. 3 in.
Shipping weight	1,000 lbs.

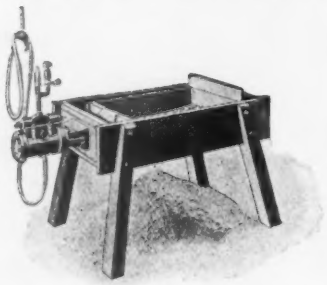
Made on Honor—Sold on Merit

Match Plates
Polishing Machines
Foot Sprue Cutters
Brass Moulders' Flasks
Tilting Tumbling Barrels
Washing and Grinding Machines

Benj. Middleditch, = Detroit, Mich.

THE BATTLE CREEK SAND SIFTER

Will do more work and is the cheapest operated device now on the market.

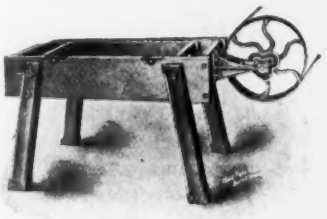


Operated by air or steam

Built for Foundry Service

For Green or Dry Sands

Facing or Core Sand Mixing



Operated by hand or belt power

Sent on 30 days' trial.

Large heavy Screen 18" x 30". We guarantee satisfaction.

MANUFACTURED BY

Battle Creek Interior Finish Company

Write for Catalogue BATTLE CREEK, MICHIGAN